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EDITORIAL

The B.B.C. Silver Jubilee

WE take time off this month from the more abstruse side of "wireless" to devote it to the most far-reaching development of it in the number of human beings it directly affects, namely radio broadcasting. The occasion is the twenty-fifth anniversary of British broadcasting and we take great pleasure in congratulating the B.B.C. on reaching its Silver Jubilee and in wishing it "many happy returns of the day."

The story of the first 25 years of the B.B.C. has been told in detail both in print and in broadcasting during the past few weeks, and the highlights of 25 years of programmes have been called to our minds by broadcast talks, feature programmes and recordings. But it is on the engineering side that we would wish to dwell because it seems to us that too little is known about it, a fact to which the relatively great freedom from interruption of programme services due to technical breakdown has certainly contributed.

Starting in 1922 with some few engineers under the inspiring enthusiasm of Capt. P. P. Eckersley, 1-kilowatt transmitters carried the British Broadcasting Company's programmes to a mere handful of listeners, many of them amateur and experimenters. Those were the days of *Experimental Wireless* in more senses than one, for this journal was founded under that name shortly afterwards in October 1923. The addition of *Wireless Engineer* to the title did not come until later—in September 1924.

In 1929 Sir Noel Ashbridge (then Mr. Ashbridge) became Chief Engineer of the British Broadcasting Corporation, to be followed in this post in September 1943 by Mr. H. Bishop, although Sir Noel Ashbridge remains the Corporation's principal technical adviser. It is on Sir Noel Ashbridge's and Mr. Bishop's shoulders then that the main burden of directing the growth of the B.B.C. engineering division has fallen. A few figures will most eloquently express this growth. At the outbreak of war in 1939, the B.B.C. was operating sixteen long- and medium-wave transmitters with a total power of 900 kW and eight short-wave transmitters with a total power of 450 kW—the engineering-divison staff totalling 1,675. Major developments between 1922 and 1939 included in these figures are the Regional twin-wave transmitting stations of which Brookmans Park, opened in 1929, was a pioneer not only in this country; the Empire broadcasting station at Daventry of which two transmitters were opened in December 1932; and the long-wave 150-kW transmitter at Droitwich which came into service in 1934. The old Daventry 5XX 25-kW long-wave transmitter, which it replaced, was opened in July 1925, and was at that time unique in the world.

The peak of engineering-division effort came during the war, in 1943 and 1944, when the B.B.C. operated a total of 121 broadcasting transmitters with an aggregate power of 6,240 kW. Of these 43 were short wave with a total power of 3,105 kW. Studio and recording facilities expanded very greatly ; disc consumption, for instance, increasing from the pre-war figure of 250 per week to 5,000 per week. The engineering-division staff at its maximum in 1944 totalled 4,137. At the present time it totals some 3,700 for the sound and television services. The latter was started in the London area on 2nd November 1936, was interrupted by the war on 1st September 1939, and was resumed on 6th June 1946. The B.B.C. has plans for extending this service so as to bring far more potential viewers within range.

We have quoted the above figures because we believe that the size and extent of the operations of the B.B.C. engineering division are not generally known. But we do not thereby suggest that size alone is what matters. The smallest staff which will properly carry out the work is generally a surer sign of efficiency, and the engineering division of the B.B.C. will be judged by the public it exists to serve not by its size but by the technical service it provides. The B.B.C. itself does not claim to be able to give a perfect service of all three domestic programmes to all listeners in the British Isles but the limitations of coverage, which affect mostly the Third Programme (only 50% of listeners in primary service areas of this programme is the B.B.C. claim, while 97% is the corresponding figure for the Home and Light programmes), are due to wavelength shortage over which the B.B.C. has no control. It is good news, therefore, although insufficiently publicized as yet, that the B.B.C. is at present building a high-power experimental station near London which will serve as a prototype to a chain of ultra-short-wave frequency-modulation stations which it is hoped will ultimately solve most coverage problems.

Where the B.B.C. does have full control over transmission facilities, as in the technical quality of the radiated transmissions it is fair to say that while the quality is not always impeccable and does not always satisfy "quality enthusiasts," it does reach a satisfactorily high standard for a large proportion of transmissions and is very frequently well ahead of the quality produced by the receivers in the hands of the ordinary listener. We believe the B.B.C. itself to be "quality conscious" and welcome the inauguration of the frequency-modulation transmissions as a means of extending the already good quality, available to the few who live close to existing B.B.C. stations, to a far wider audience.

The B.B.C. has set high technical standards in its 25 years of existence and it has with but relatively few lapses been able to preserve those standards. But the enduring interest in broadcasting for the large majority of people is in what comes out of the loudspeaker and not in the technical means by which it reaches them. And so we cannot conclude this editorial without referring to one to whom is due in so large a measure the high standards of culture and public service which have come to be inherent in British broadcasting—Lord Reith. To quote some words of the present Director-General of the B.B.C., Sir William Haley, K.C.M.G., in a recent article in the *Radio Times*: "No celebration of the B.B.C.'s Silver Jubilee can be complete without an appraisal of what British broadcasting, and the nation as a whole, owes to him. There are few homes that have not benefited by his imaginative concept of what ends broadcasting could serve. Life for millions in this generation has been made richer and fuller by his efforts. He came to launch broadcasting. No chart or course existed. There was no experience to draw upon, no traditions to guide. He went forward with energy, vision, and faith. There were opponents. They were not serious. There was a vast multitude who saw little in the new invention and who did not much care to what use it was put. That was most serious. The story will one day be told how Mr. Reith, as he then was, went about, cajoling, urging, bullying, exhorting those forces that stand for what is best in the community to realize what broadcasting could do for them. There is little he foresaw that has not since come to pass. Not all his dreams, perhaps, have been realized. But there is none yet proved finally incapable of realization."

L. W. H.

SIGNAL-NOISE RATIO IN RADAR*

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SUMMARY.—Small pulse signals are difficult to detect when mixed with noise. A method is described by which the visibility of these pulses is improved.

The principle is to cut either the upper part or the lower part of the received signal by a limiter. On a cathode-ray tube it appears then as a brilliant line in which the brilliancy is increased or decreased at the positions of the signal pulses. It is shown that the visibility of very small pulses is appreciably increased.

Apart from its practical importance, this study is an example of the application of statistics to radio problems.

THE object of this study is to describe a method of increasing the visibility of small pulses on the cathode-ray tubes of pulse receivers, particularly when these pulses are mixed with strong noise.

The method is deduced from the law of distribution of the peak amplitudes in the noise.

In Fig. 1 are represented a noise (a), a signal pulse (b), the resultant of the noise and the signal pulse (c). In addition some other curves are shown, and their purpose will now be explained.

The noise may be regarded as the resultant of an infinite number of impulses of very short duration, the amplitudes being distributed at random. However, these amplitudes follow Gauss's law of distribution, and if we trace a curve the ordinates of which represent the peak amplitude of the noise pulses and the abscissae the proportion of pulses having a given peak amplitude (that is, the value of the probability for a noise pulse to have a given amplitude) we get a curve such as the one shown in Fig. 1 (a). The most probable value of the noise-pulse amplitude is zero, and the probability decreases very quickly when the amplitude increases either positively or negatively. If z is the amplitude of the pulses and p the probability, this curve may be represented by the equation:

$$p = \frac{k}{\sqrt{\pi}} e^{-k^2 z^2} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where k is a constant connected to the root-mean-square value $\overline{\alpha}_n$ of the noise amplitude by the relation:

$$k = \frac{1}{\overline{\alpha}_n \sqrt{2}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Now the movement of the spot of the cathode-ray tube being at random, the time during which the spot is at a certain amplitude follows the same kind of law, and the distribution of the intensity in the shaded area produced by the movement of the spot also follows the same law. That is to say, the curve of Fig. 1 (a) also represents the law of the vertical distribution of the intensity in the shaded area produced by the noise. This intensity is maximum on the abscissa line and decreases very quickly when one goes off it.

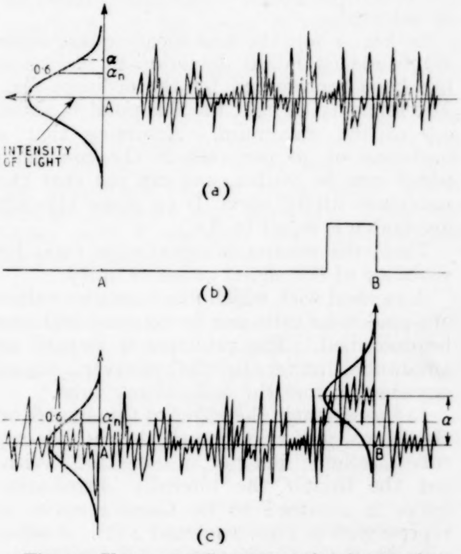

Fig. 1. *Shows a small recurrent signal appearing on the cathode-ray tube of a sensitive radar receiver in the presence of strong noise. The noise and signal are shown at (a) and (b) respectively, and combined at (c).*

It must be noted that this is really a hypothesis, exactly as Gauss's law of distribution. It is shown in statistics that if a number of independent events occur at random, the law of distribution of all the events added together is Gauss's law provided that the number of independent events is great. The above hypothesis is probably correct. However, even if the intensity distribution follows a different kind of law, the general principles of the method explained below can still be applied.

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*MS. accepted by the Editor, November 1946.

Now let us see what happens when the signal pulses are mixed with the noise. Fig. 1 (c) represents the resultant of the noise and the pulses. When a signal pulse appears, it lifts up the noise by an amount equal to the amplitude of the signal pulse. There is also traced the intensity distribution law for a point A where there is no signal pulse and for a point B where the signal pulse is present. The intensity distribution law is the same, but the pulse raises the curve by an amount equal to its amplitude.

We are now in a position to find out the value of the minimum amplitude of the signal pulse which can be visible ; that is, the minimum value of the signal/noise ratio for which the presence of a signal pulse can be detected.

In Fig. 1 (c), the root-mean-square noise amplitude (standard deviation in statistics) has been represented by the ordinate $A\alpha_n$. The intensity of light for this point is about 0.6 of the maximum. Assuming that a variation of 40 per cent is the minimum which can be visible, one can see that the minimum lift of curve B to make this lift detectable is equal to $A\alpha_n$.

Thus, the minimum signal/noise ratio for visibility of the signal pulses is unity.

A method with which much smaller values of signal/noise ratio can be detected will now be described. The principle is to add an amplitude limiter to the receiver, placed anywhere before the cathode-ray tube.

Let us examine the effect of this limiter on the intensity distribution on the cathode-ray tube. Assume first no pulse signals. Without the limiter the intensity distribution curve is assumed to be Gauss's curve as represented in Figs. 1 (c) and 2 (a). Assume now that the limiter cuts all amplitudes above a given value $A\alpha_L$ [Fig. 2(a)]. Then all the intensity of light which is above the horizontal line passing through point α_L is concentrated on this line. This is due to the fact that whenever the spot has a tendency to cross the line and trace a curve above it, it is stopped by the limiter and stays on this boundary line during the time which it would have spent above it without the limiter. Thus the average intensity on this line is equal to the area of the intensity distribution curve above this line. This average intensity is negligible when $A\alpha_L$ is great and increases gradually when $A\alpha_L$ decreases and becomes maximum when $A\alpha_L = 0$. The law is the same for negative values of $A\alpha_L$, provided that the limiter stops the spot when it tries to cross the limiter line. This has been assumed in tracing the intensity distribution curves of Fig. 2. The curve representing the average intensity on the limiter line as a function of $A\alpha_L$ is given in Fig. 2 (a). It is a curve having a sharp cusp for $A\alpha_L = 0$, whereas the amplitude of the noise intensity distribution varies very slowly for very small values of $A\alpha_L$. Starting from zero value, if $A\alpha_L$ increases by a very small quantity the noise intensity light will not vary, but if we use a limiter the variation will be important. This property is used in order to increase the visibility of very small pulses. The principle is to use a limiter, preferably adjusted so that $A\alpha_L$ is small or zero, and to observe on the boundary line produced by the limiter, the difference of intensity between the points where there is only noise and the points where the noise is mixed with a signal pulse.

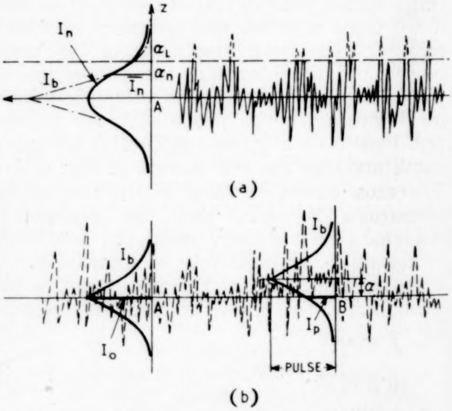

Fig. 2. *Noise on a c.r. tube is shown at (a) for the case of a limiter operating at the level* $A\alpha_L$ *and at (b) with the addition of a signal pulse of amplitude* α.

Fig. 2 (b) represents the average intensity of light on the boundary line for two points ; one, A, where there is no signal pulse and one, B, where the noise is mixed with a signal pulse. The pulse has the effect of lifting up the curve by a height equal to the amplitude of the pulse. The average intensity on the boundary at point A is I_0, the maximum amplitude of the curve, and at point B it is I_p. The difference $I_0 - I_p$ is proportional to α when α is small because the curve near the cusp is approximately constituted by two lines. Without the limiter for very small values of α there is no appreciable variation of intensity as has been explained above, and as is shown in Fig. 1 (c).

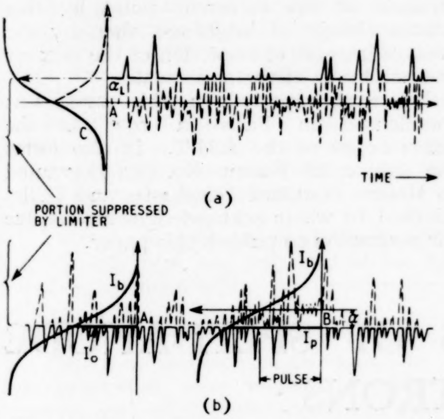

Fig. 3. *The conditions are the same as for Fig. 2, but the limiter is assumed to stop the spot from crossing the boundary line. It is confined above it for* (a) *and below it for* (b) *irrespective of the value and sign of* $A\alpha_L$.

In Fig. 2 it has been assumed that the limiter stops the spot where it tries to cross the limiter line upwards for $A\alpha_L$ positive and downwards for $A\alpha_L$ negative. The intensity distribution of light on the boundary line is then a symmetrical curve as shown on Fig. 2 (b). In practice, the limiter behaves in a way which is independent of the position of the boundary line. The intensity distribution of light on the boundary line has then an asymmetrical shape as shown in Fig. 3 (a) for a limiter stopping the spot where it crosses the boundary line downwards, and in Fig. 3 (b) for a limiter stopping the spot where it crosses the boundary line upwards. Fig. 3 (b) shows this curve in the absence of a signal pulse (point A) and in the presence of a signal pulse (point B).

To obtain an idea of the improvement introduced by this method some calculations are necessary.

Let I_n be the noise-light intensity for an ordinate of abscissa z. The law of distribution of the intensity of light is given by

$$I_n = \frac{k}{\sqrt{\pi}} e^{-k^2z^2} \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

where k is a constant connected to the root-mean-square value of I_n by the relation.

$$k = \frac{1}{I_n\sqrt{2}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

Let I_b be the intensity of light on the boundary line $z = \alpha$ when there is a limiter. Then we have

$$I_b = \int_\alpha^\infty I_n \, dz = \int_0^\infty I_n \, dz - \int_0^\alpha I_n \, dz$$

$$= \frac{1}{2} - \frac{k}{\sqrt{\pi}} \int_0^\alpha e^{-k^2z^2} \, dz = \frac{1}{2} - \frac{1}{\sqrt{\pi}} \int_0^{k\alpha} e^{-t^2} \, dt$$

$$2 I_b = 1 - \theta(k\alpha) \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where $\theta(k\alpha)$ is the well-known integral used in statistical problems. Numerical tables of this integral exist and from these tables the curve of Fig. 4 can be traced. In this figure there is also included the curve representing I_n, and to make the comparison easier, the curves have been drawn with the same maximum amplitude. The root-mean-square amplitude of the noise is represented by the abscissae α_n as in Fig. 1 (c). The intensity I_n corresponding to the root-mean-square amplitude is also indicated. It can be seen that with curve I_b the same amplitude I_n can be obtained with half the deflection α_n; that is to say, with half the amplitude of the signal pulse which will be necessary with curve I_n. *Thus, the above method improves the signal-to-noise ratio by about 6 db.*

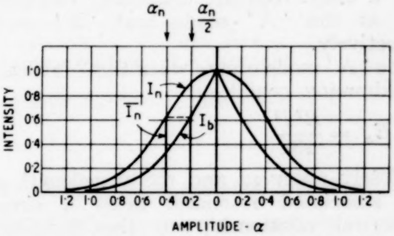

Fig. 4. *The average intensity distribution of light on a horizontal line on the cathode-ray tube versus the distance of this line from the axis, without limiter (curve* I_n*) and on the boundary line when a limiter is used (curve* I_b*).* α_n *and* I_n *are respectively the root-mean-square values and the intensity of the noise.*

It may be noted that the adjustment of the limiter may be independent of the amplitude of the noise and signal pulses, if one chooses a limiter suppressing either the positive or the negative part of the signals. Any kind of limiter can be used. Usually a diode connected in shunt on the signal is used. Depending on the connections, either the positive or the negative part of the signal is suppressed.

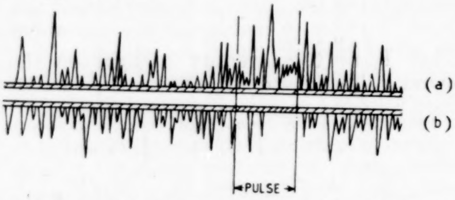

Fig. 5. *Shows a recurrent pulse of small amplitude as it appears on a c.r. tube when a limiter is used; (a) corresponds to a limiter suppressing the negative deflections and (b) the positive deflections.*

Fig. 5 is a sketch to show how a recurrent pulse of small amplitude will appear on the screen of the c.r. tube when a limiter is used; (a) corresponds to a limiter suppressing the negative part of the trace and (b) the positive part. The pulse is assumed to be positive; that is, to lift the noise upwards. This lift is visible in (a) by a great number of positive peaks where the pulse appears and in (b) by a reduced number of negative peaks. The boundary lines in (a) and (b) appear as bright traces with sudden changes of brightness where the pulse appears, reduced in (a) and increased in (b). As explained above, it is easier to detect the presence of the recurrent pulse by this sudden change of brightness than by the average increase or reduction of the number and amplitude of the noise peaks.

The work reported in this paper was commenced in Paris in 1939 at the Laboratories of the L.M.T. It also forms the subject of Patent No. 581698 granted to Messrs. Standard Telephones and Cables Limited to whom acknowledgments are due for permission to publish this paper.

WAVELENGTH LAWS OF SPLIT-ANODE MAGNETRONS*

By G. H. Metson, M.C., Ph.D., M.Sc., B.Sc. (Eng.), A.M.I.E.E.

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1. Introduction

THE two principal modes of operation of a magnetron are commonly described as the 'A' mode and 'B' mode respectively.

The 'A' mode occurs when the "critical" or skimming condition,

$$E_a = \frac{H^2 d^2}{181}$$

is closely observed and the wavelength of the associated resonator bears a simple numerical relationship to the flight-time of an electron over its cardioid path. The flight-time is characterized by Okabe's relationship,

$$\lambda = \frac{10.650}{H}$$

and the generated wavelength by,

$$l = n\frac{\lambda}{4}$$

where l is the length of a Lecher-wire system resonator, H is the magnetic intensity, and n a series of even integers. The appearance of even integers only is significant and shows that the A-mode oscillations originate from a generator of zero internal impedance. In general, the oscillation is a weak one and becomes increasingly difficult to develop for values of n greater than 6.

The B-mode is entirely different in character from the A-mode in that it appears to be independent, within wide limits, of flight-time and is essentially a function of the resonator system. If the resonator is a Lecher wire, the generated wave will be found proportional to the effective length of the Lecher system and generally independent of the electrical parameters of the tube. Thus, if the length of the Lecher system is l cm, the generated wave-length λ cm will conform to the linear equation

$$\lambda = ml + c \qquad \ldots \quad \ldots \quad \ldots \quad (1)$$

where m and c are constants of tube geometry.

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* MS accepted by the Editor, November 1946.

The analytical significance of this equation is the prime concern of this article.

2. Experimental Method

The B-mode wavelength laws for three different tubes were measured over a series of ranges extending from 50 cm to 350 cm. The wavelengths refer to measurements on heavy-gauge parallel copper rods and may be regarded as corresponding to waves propagated in free space. The experimental procedure was conventional and consisted of the generation of oscillations in a tube with a specific length l cm of resonating Lecher wire attached to the anode plates. The wave-length λ cm of the generated wave was measured on a second Lecher wire of considerable length and coupled to the resonator by a loop aerial system. Variation of λ with l was then measured over a range suitable to the circumstances of a particular experiment.

Two of the tubes were of the two-plate split-anode type and the third of the four-plate split-anode type.

3. B-Mode Wavelength Laws

The B-mode wavelength laws, or λ/l characteristics were measured under the several sets of circumstances indicated in Fig. 1.

Two points shown here require brief explanation. The open-circuited driving of a magnetron shown at (b) is unusual but can be readily achieved by feeding the h.t. plate voltage through an inductance consisting of a few suitably spaced turns of wire connected across the Lecher system. Two symmetrical arrangements of connecting the plates of a four-plate tube are possible and are shown at (c) and (d) respectively. With the four-plate connection (d) it is possible to drive the magnetron into two distinct and separate B-type modes ;—one develops with the magnetic-field strength considerably greater than the "critical" value while the other sets in with H only slightly greater than the "critical" value. The first mode will be described as the B_1-mode and the second as the B_2-mode.

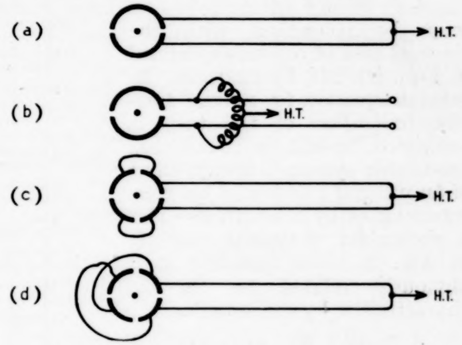

Fig. 1. *Various operational arrangements are shown :* (*a*) *Normal operation of two-plate tube, wavelength* λ ; (*b*) *open-circuited operation of two-plate tube, wavelength* $\lambda^{o/c}$; (*c*) *two-plate operation of four-plate tube, wavelength* λ^{II} ; (*d*) *four-plate operation of four-plate tube, wavelength* λ^{IV}.

In all cases the λ/l characteristic was found to conform to Equ. (1). A summary of the laws obtained is set out in Table 1.

TABLE I.

Tube No.	Oscillation Law	Remarks
1	$\lambda = 3.84l + 41$	Normal 2-plate operation
1	$\lambda^{o/c} = 1.94l + 24$	Lecher system open-circuited
2	$\lambda = 3.84l + 46$	Normal 2-plate operation
3	$\lambda^{II} = 4.47l + 50$	2-plate mode of 4-plate tube
3	$\lambda^{IV}_{B_1} = 4.31l + 60$	4-plate B_1-mode of 4-plate tube
3	$\lambda^{IV}_{B_2} = 1.39l + 14.4$	4-plate B_2-mode of 4-plate tube

4. Resonance in a Lecher System

A Lecher system is essentially a parallel-wire transmission line and is, therefore, capable of solution by classical methods. Under conditions of free oscillation or resonance the λ/l characteristic for such a system is given by,

$$l = n\lambda/4 \quad .. \quad .. \quad .. \quad .. \quad (2)$$

where $n = 1, 3, 5 \ldots$ for dissimilar terminations

and $n = 2, 4, 6 \ldots$ for similar terminations.

The terminations referred to are either zero or infinite impedances.

The B-mode oscillation bears many of the physical characteristics of free-oscillation or resonance but, if such is actually the case, the general law

$$\lambda = ml + c$$

must be reconciled with the classical case of resonance defined in Equ. (2). If, for example, the general equation for normal two-plate operation of the tube is evaluated, it will be found that the Lecher system is always short of an integral number of quarter-wavelengths by a length $\varDelta$. This is shown for a typical example in Fig. 2. The quantity $\varDelta$ is obviously related to the λ/l characteristic by the equation

$$\lambda = 4(l + \varDelta) \quad \ldots \quad \ldots \quad (3)$$

It may be well at this stage to assign some formality to this function $\varDelta$ and it will therefore be defined as the shortest length that must be added to a Lecher system oscillating in the B-mode to make it equal in length to an integral number of quarter-wavelengths.

Numerical evaluation of the $\varDelta/\lambda$ characteristics from Equ. (1) and (3) has been made for the three tubes and the results are set out in Fig. 3. The characteristics are all linear.

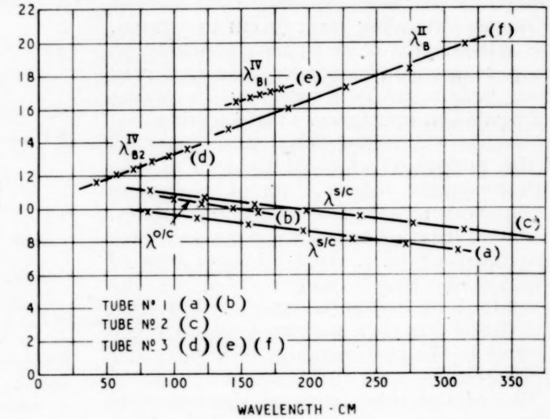

Fig. 3. *Variation of $\varDelta$ with λ; curves (a) and (b) are for tube No. 1, (c) for tube No. 2, and (d), (e) and (f) for tube No. 3.*

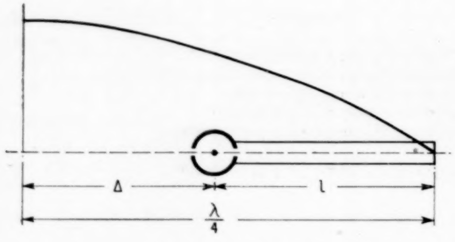

Fig. 2. *Normal two-plate oscillation.*

5. Development of Length $\varDelta$

Assuming free resonance, it would appear that the internal impedance of the B-mode generator must identify itself with the impedance of a length $\varDelta$ of Lecher wire open-circuited at its distance end. This assumption can now be put to test by development of the transmission characteristics of the open-circuited Lecher system of length $\varDelta$.

If the Lecher system has a complex propagation constant p and characteristic impedance Z_0, then the sending-end impedance of a length $\varDelta$ of line open-circuited at its distant end is given by,

$$Z = Z_0 \coth p\varDelta$$
$$= Z_0 \coth (\alpha + j\beta)\varDelta$$

where α = attenuation constant

and β = phase constant.

Expanding the complex hyperbolic

$$Z = Z_0 \frac{\cosh (\alpha + j\beta)\varDelta}{\sinh (\alpha + j\beta)\varDelta}$$
$$= Z_0 \frac{\cosh \alpha\varDelta \cos \beta\varDelta + j \sinh \alpha\varDelta \sin \beta\varDelta}{\sinh \alpha\varDelta \cos \beta\varDelta + j \cosh \alpha\varDelta \sin \beta\varDelta}$$

The characteristics of the Lecher system are such that the attenuation in nepers per cm will be very small numerically and as $\varDelta$ is also small, the hyperbolic functions of $\alpha\varDelta$ may be written,

$$\cosh \alpha\varDelta = 1$$
$$\sinh \alpha\varDelta = 0$$

without sensible error. Inserting these in the full expansion,

$$Z = Z_0 \frac{\cos \beta\varDelta}{j \sin \beta\varDelta}$$
$$= -jZ_0 \cot \beta\varDelta \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

The quandrantal rotor indicates that the impedance is wholly reactive. The phase constant β defines the angular rotation of line. It therefore expresses itself in terms of wavelength λ as,

$$\beta = \frac{2\pi}{\lambda}$$

whence,

$$Z = Z_0 \cot (2\pi\Delta/\lambda) \quad \dots \quad \dots \quad (5)$$

The characteristic impedance Z_0 is directly derivable from the primary constants of the Lecher system and at high frequencies is given by,

$$Z_0 = \sqrt{L'/C'} \quad \dots \quad \dots \quad (6)$$

where L' and C' are the inductance and capacitance per unit length of the system.

The impedance Z of the open-circuited system of length Δ is calculable from Equs. (5) and (6) and the values for tubes Nos. 1 and 3 are set out in Fig. 4 over the range 100–500 Mc/s.

Since the impedances are wholly reactive and Fig. 4 shows them to be capacitive in character, it is apparent that the curve of the figure can be recast as "capacitance frequency" characteristics. Thus,

$$Z = \frac{1}{\omega C}$$

where

$$\omega = 2\pi f.$$

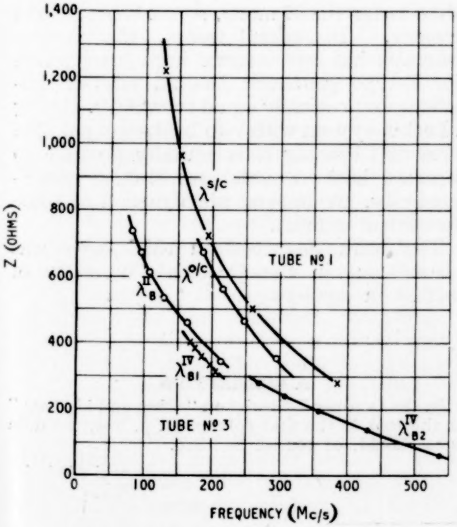

Fig. 4. *Variation of Z with frequency.*

This readjustment has been made and the C/f characteristics are set out in Fig. 5. It should be emphasized at this point that the value of C in micromicrofarads at any particular wavlength λ cm represents the equivalent of the open-circuited length Δ which must be added to the Lecher system to make it equal to an integral number of quarter-wave lengths.

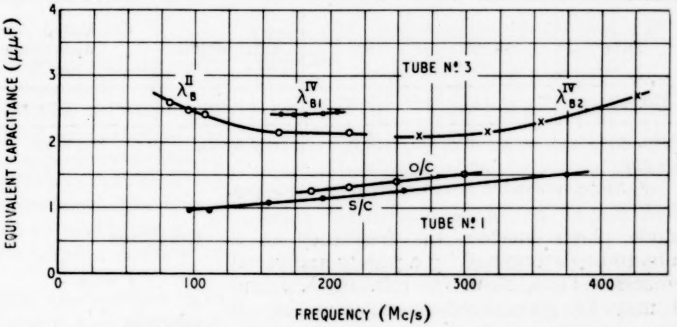

Fig. 5. *Equivalent capacitance of tube as a function of frequency.*

Examination of the curves brings to light two significant points. First, the equivalent capacitance for the Δ of a tube is sensibly independent of the condition under which the tube operates; e.g., close-circuited or open-circuited Lecher resonator; B_1- or B_2-mode; 2-plate or 4-plate connection. Secondly, having regard to the great frequency range involved, nearly 350 Mc/s, the equivalent capacitance shows remarkably small variation with frequency. Neglecting fractional variations over the frequency range, mean constant values are,

Tube No. 1 $C = 1.2\ \mu\mu\text{F}$

Tube No. 3 $C = 2.4\ \mu\mu\text{F}$

Tube No. 2 has been omitted in these later characteristics as it is similar in form to Tube No. 1 and gives rise to similar results,—vide Fig. 3.

Constancy of equivalent capacitance for Δ over the frequency range at once gives rise to the implication that it can be identified with the electrostatic capacitance of the magnetron anodes—the magnitude of 1–$2\mu\mu$F would appear to be of comparable order. The capacitances of the plates of the two tubes have therefore been calculated and the results are set out in Table 2.

From these results it is apparent that the equivalent capacitance of Δ approximates closely to the constant electrostatic capacitance of the magnetron anodes.

5. Frequency Prediction

Identification of the equivalent capacitance with the electrostatic capacitance of the anode plates enables the frequency of a tube to be determined by a purely analytical process. Thus, Equ. (3) relating λ, l and Δ may be generalized to account for all B-type modes.

TABLE II

Tube	Radius	θ*	Axial length	Calculated Anode Capacitance ($\mu\mu$F)	Equivalent Capacitance of Δ ($\mu\mu$F)
No. 1 ..	0.47 cm	12.2°	2.0 cm	1.74	1.2
No. 3 ..	0.35 cm	10.2°	2.0 cm	2.39	2.4

* Angle subtended at tube centre by anode gap.

$$n\frac{\lambda}{4} = l + \Delta \quad \dots \quad \dots \quad \dots \quad (7)$$

where $n = 1$ for fundamental mode (B_1)

$n = 3$ for 2nd harmonic mode (B_2), etc.

Then from Equ. (5)

$$Z = Z_0 \cot (2\pi\Delta/\lambda)$$

$$= \frac{1}{\omega C}$$

or $$\Delta = \frac{\lambda}{2\pi} \tan^{-1}\omega C Z_0$$

Whence

$$n\frac{\lambda}{4} = l + \frac{\lambda}{2\pi}\tan^{-1}\omega C Z_0$$

or $$\lambda = \frac{4\pi l}{\pi n - 2\tan^{-1}\omega C Z_0} \quad \dots \quad \dots \quad (8)$$

where λ = generated wavelength
l = actual length of Lecher system
C = electrostatic capacitance of plates
Z_0 = characteristic impedance of Lecher system
$\omega = 2\pi f$
$n = 1, 3, 5 \dots$

The discrete frequencies at which a tube may operate at any value of l can therefore be calculated from the geometry of the anode and Lecher wires.

6. Conclusions

The general B-mode oscillation law of a split-anode magnetron with Lecher wire resonator,

$$\lambda = ml + c$$

is in complete accord with the classical wavelength laws of a freely resonating transmission line with dissimilar terminations, viz

$$l = n\frac{\lambda}{4}$$

where $n = 1, 3, 5 \dots$

The analagous form for the magnetron case may be written

$$l' = n\frac{\lambda}{4} \quad \dots \quad \dots \quad \dots \quad (9)$$

where $l' = l + \frac{\lambda}{2\pi}\tan^{-1}\omega C Z_0$

In conclusion it may be pointed out that the only difference between the basic wavelength laws for the A-mode and B-mode lies in the apportionment of the integer n. For the A-mode, n is always an even integer whereas for the B-mode, n is a series of odd integers. In other words, the A-type generator has zero internal impedance whilst the B-type generator has an internal impedance numerically equal to infinity. Using a Lecher system with two bridges of suitable form and spacing it is actually possible to generate both A-mode and B-mode simultaneously, an unusual phenomenon of some theoretical interest.

The work described in this paper was carried out in the Queen's University of Belfast in 1938-39.

A CORRECTION

In the October Editorial on " Ohm and his Law " at the foot of the first column on p. 285, the date 1929 should, of course, be 1829.

G.W.O.H.

VALVE OSCILLATOR*

Operation and Properties

By *J. R. Tillman, Ph.D., A.R.C.S.*

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1. Introduction

IT was recognized as long ago as the early 1920's that the dependence of the frequency of oscillation of a valve oscillator on the non-linear properties of the maintaining circuit was a problem requiring elucidation. It has for that reason been the subject of several investigations[1], theoretical and practical, references to which are made here in order to put the present analysis in correct perspective.

The methods of tackling the problem have depended to some extent on the most favoured contemporary types of maintaining circuit. In most analyses an LC oscillator has been regarded as a combination of a parallel resonant circuit and a negative resistor, the prime function of the latter being to neutralize the losses occurring in the former. Because incomplete neutralization results in no oscillation, and exact neutralization had no practical significance until recently, over-neutralization was the only condition considered. The oscillations generated would be expected to have infinite amplitude if the negative resistor obeyed Ohm's Law. But in practice the current (i) —voltage (v) relationship of all negative resistors eventually departs from linearity in such a manner as to impose a limitation on the amplitude. While it is not difficult to appreciate that the non-linearity causes the waveform of the signal generated to be other than sinusoidal, it is less obvious that the frequency of the oscillation will differ from that calculated from a knowledge of the constants of the resonant circuit and of the susceptance of the negative resistor.

Appleton and Greaves[2], adopting this picture of an oscillator, assumed that the non-linear relationship could be expressed by a power series, a relationship which, even when limited to a few terms, is a fair approximation to the characteristics of the dynatron and some other negative resistors. The amplitude, the fundamental frequency and the harmonic content of the signal generated were obtained by solving the equation

$$\frac{d^2 v}{dt^2} + \left\{\frac{R}{L} + \frac{\phi'(v)}{C}\right\}\frac{dv}{dt} + \frac{v}{CL} = 0, \text{ where}$$

$\phi'(v)$ is derived from the power series. The results showed that the frequency depended on the coefficients of v, v^2 . . . etc, in the power series as well as on C and L, the constants of the resonant circuit.

Ten years later Moullin[3] considered the effect of the curvature of the characteristic of the dynatron on the frequency of an oscillator of which the dynatron forms the negative resistor. He adopted a similar power series relationship and showed that the fundamental frequency is affected by the phase and magnitude of the harmonic components contained in the signal generated. He deduced that the fundamental frequency ($\omega/2\pi$) would be given by

$$\omega^2 = \omega_0^2\left[1 - F^2\left\{1 + \sum_2^\infty\left(\frac{I_n}{I_1}\right)^2\right\}\right]$$

where F is the power factor of the resonant circuit, I_n is the amplitude of the current of the nth harmonic which flows into this circuit, and $\frac{\omega_0}{2\pi}$ the limiting frequency which obtains when $\sum_2^\infty\left(\frac{I_n}{I_1}\right)^2$ is made vanishingly small. Moullin was unable to confirm his relationship experimentally. Another effect —the change of interelectrode capacitance with change of operating conditions of the dynatron—undoubtedly predominated, but it is not clear from his paper that he made best use of the admittedly limited technique then available to reduce its relative importance. In an appendix to his paper he extended the work of Appleton and Greaves sufficiently to show that the results of his analysis, based so largely on physical arguments, were in agreement with those obtained by the earlier workers based on rigid mathematics.

Simultaneously Groszkowski[4] studied the general problem in a paper called " The

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* MS accepted by the Editor, November 1946.

interdependence of frequency variation and harmonic content, and the problem of constant-frequency oscillators." He rejected the method of Appleton and Greaves on the grounds that it proves to be extremely laborious to apply, especially where negative resistors having complicated *i-v* relationships are concerned and that the results obtained are not easily interpreted for practical purposes. In its place he developed an analysis based on the fact that over one cycle of the fundamental frequency of oscillation the equation $\int i dv = 0$ must hold. This relationship is equivalent to a statement that there exists in any self-maintaining oscillating circuit a balance of both "real" and "imaginary" power. The former is obtained when the energy dissipated in the resistance of the components of the resonant circuit is exactly provided by the maintaining circuit and the latter when the mean magnetic energy in the inductor of the resonant circuit equals the mean electric energy in the capacitor of the circuit. The second condition, involving "wattless" energy, must be satisfied even in the presence of harmonics, whose currents flow chiefly through the capacitor, thereby increasing the electric energy more than the magnetic.

Equilibrium is restored by the fundamental frequency readjusting itself to some value, lower than that obtaining in the absence of harmonics, at which the magnetic energy due to the fundamental frequency exceeds the corresponding electric energy by the requisite amount. Groszkowski's analysis avoided the necessity of initially specifying the law connecting i and v of the negative resistor and led, via mathematics simpler than that found necessary by Appleton and Greaves, to the result

$$\frac{\omega - \omega_0}{\omega_0} = -\tfrac{1}{2}\{3m_2^2 + 8m_3^2 + \ldots + (n^2 - 1)\, m_n^2 \ldots\}$$

where m_n is the ratio of the voltage of the nth harmonic, measured across the resonant circuit, to that of the fundamental. The results of Appleton and Greaves were shown to be in agreement with this relationship. Experimentally Groszkowski was more successful than Moullin; he obtained confirmation to a moderate degree of accuracy. Finally he went some way towards generalizing the problem for the triode oscillator with back coupling; e.g., the Hartley. A little later van der Pol[5], who had already made very important contributions to non-linear circuit theory, tackled the problem of this type of oscillator generally; he derived Groszkowski's relationship by starting from the fundamental differential equation.

Now Groszkowski's relationship can be applied to any oscillator. But for any particular one a knowledge or calculation of the harmonic content to be expected is necessary before any exact prediction of the frequency can be made; individual circuits therefore still require individual analyses, which will in general be complicated. Groszkowski's result is independent of the phase angles of the harmonic components, and might therefore seem to be at variance with the conclusions drawn by Moullin relating to these angles. But it must be remembered that Moullin was using a particular *i-v* law from which in turn (*a*) he calculated the phases of the voltages of the harmonics generated, (*b*) he deduced that these harmonics would affect the frequency of oscillation and (*c*) he noted that if the phases of the harmonics were changed by certain amounts the harmonics would cease to have any such influence. An additional conclusion should, however, be drawn from his work, namely that such changes of phase can be made to take place completely in his two-terminal network only if the amplitudes of these voltages are simultaneously reduced to zero.

2. The Circuit to be Analysed

The circuit to be considered in detail here is that suggested by Lynch and the author[6], who analysed qualitatively some aspects of its performance and claimed for it certain advantages which will be dealt with later. Fig. 1 gives the circuit in all necessary detail. The circuit can, for the purpose of analysis, be split in two ways; either by the broken line or by the dotted line.

For the first division the two sections may be classed as the resonant circuit and the negative resistor. Considered alone the latter has already received attention by Brunetti and Greenough[7] and others[8, 9]. But its properties, so thoroughly investigated there, and found to be so superior to those of many other negative resistors, have been only those manifest over the linear range of operation; whereas some aspects of its performance outside this range need to be considered when it forms part of an oscillator. This division, though corresponding to that used by

Appleton and Greaves, Moullin and Groszkowski, is not pursued.

For the second division the classifications are discriminating circuit and maintaining circuit or amplifier A. Both parts are three-terminal networks, and their properties are considered in the following sections.

2.1 *The Discriminating Circuit*

The discriminating circuit consists of a blocking capacitor C_1 of large value, a resistor R_1 and the resonant circuit here represented as a capacitor C_0 in parallel with an inductor of series inductance L and series resistance R; the magnification, Q, of the inductor is therefore $\omega L/R$. The equivalent resonant circuit, at the frequency $\omega/2\pi$, shown in the full line square of Fig. 1, where $L' = L(1 + 1/Q^2)$ and $R' = R(1 + Q^2)$, is in general preferred in this article. The parallel resonant frequency of the inductor and capacitor is $\frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{L'C_0}}$ and, at this frequency, the ratio $\frac{R' + R_1}{R'}$ will be called z'.

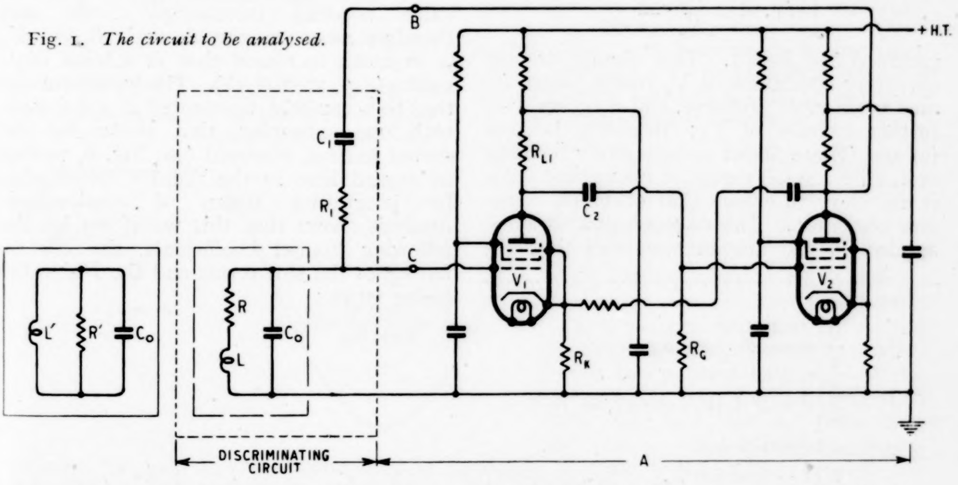


Fig. 1. *The circuit to be analysed.*

2.2 *The Maintaining Circuit or Amplifier.*

2.21 *Linear Operation*

In the following analysis, whenever low levels of input signal are concerned, it will be assumed that the amplifier (*a*) has a high overall voltage gain, n_0, despite the degeneration, which is preferably heavy, (*b*) introduces negligibly small phase shift and (*c*) has a low value of output impedance and a high value of input impedance. Where the frequency concerned, $\omega/2\pi$, is in the range 10 c/s–1 Mc/s, straightforward designs will meet these requirements sufficiently well.

2.22 *Performance Outside the Linear Range of Operation.*

As the level of the input signal supplied to the amplifier increases, the ratio of output voltage V_0 to input voltage V_1 at first remains n_0 to a high degree of accuracy. With the assumptions, justified by normal practice, that the signal level at the control grid G_1 of V_2 is several times that between the control grid G_1 and the cathode K of V_1, that the anode voltage and maximum possible anode excursion of V_2 are such that "bottoming" does not occur for negative values of V_{G1} of this valve, and that V_1 and V_2 have approximately similar characteristics, the first sign that the limit of the linear region has been reached will appear in one of two ways. Either (*a*) the signal applied to the control grid of V_2 will, at its maximum negative value, drive this grid to its cut-off point, or (*b*) it will, at its maximum positive value, cause this grid to draw current, i_G. With normal operating conditions for V_2, (*a*) and (*b*) are about equally likely to occur first. When (*a*) occurs first any further increase of V_1, here assumed to be sinusoidal in waveform, causes the output signal to become distorted in the manner shown in Fig. 2(*b*). When (*b*) occurs first this further increase of V_1 does not cause the corresponding section of the waveform of the output voltage to show appreciable distortion provided the input impedance of V_2 during the period of the drawing of grid current is much greater than R_{L1}. But a secondary effect of importance takes place ; an additional charge accumulates on the plates of C_2 biasing the control grid of V_2 in the negative direction by a voltage V_G, which is given approximately by the relationship

$$\int_0^{2\pi/\omega} i_G \, . \, dt = \frac{V_G}{R_G} \cdot \frac{2\pi}{\omega}$$

provided $\omega C_2 R_G \gg 1$. This change of the operating conditions of V_2 makes effect (*a*) now much more probable, and it occurs with further increase of V_1 ; moreover because (*a*) and (*b*) are about equally likely to occur first, only a small excess of the critical value is necessary to ensure that effect (*a*) comes into operation. The degeneration which is applied to the amplifier ensures that the waveform of the anode current, when overloading occurs, approximates to that which would be expected if the anode current versus control-grid voltage characteristic were strictly linear down to an abrupt cut-off. It ensures also that the distortion of the signal at the other extremity is small because it much reduces the loss of overall gain which results from the shunting of the nominal load of V_1 by the input impedance of V_2, whose value becomes increasingly lower and therefore more comparable with R_{L1} as V_1 is so much increased that i_G attains large values (e.g., 10–100 μA). The waveform can thus be accurately represented as a sine wave with one extremity, that shown by the dotted section, removed (see Fig. 2, paying no regard here to the relative amplitudes, for progressive stages of overloading). Analysis shows that this waveform has the following Fourier coefficients, the *A's* referring to the sine terms and the *B*'s to the cosine terms ;

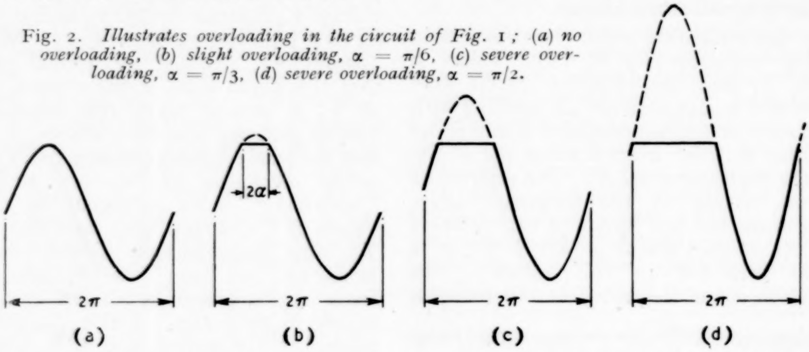


Fig. 2. *Illustrates overloading in the circuit of Fig.* 1 ; (*a*) *no overloading,* (*b*) *slight overloading,* $\alpha = \pi/6$, (*c*) *severe overloading,* $\alpha = \pi/3$, (*d*) *severe overloading,* $\alpha = \pi/2$.

$$\left.\begin{array}{l}
B_0 = \dfrac{E}{\pi}\left\{\alpha \cos \alpha - \sin \alpha\right\} \\
A_1 = \dfrac{E}{\pi}\left\{\pi - \alpha + \sin \alpha \cos \alpha\right\}, \; B_1 = 0 \\
\text{and for higher terms} \\
A_n = \dfrac{E\,(1 - \cos n\pi)}{2\pi n(n^2 - 1)}\left\{(n + 1)\sin\,(n - 1)\left(\dfrac{\pi}{2} - \alpha\right) + (n - 1)\sin\,(n + 1)\left(\dfrac{\pi}{2} - \alpha\right)\right\} \\
\text{which} = 0 \text{ when } n \text{ is even} \\
B_n = -\dfrac{E\,(1 + \cos n\pi)}{\pi\,(n^2 - 1)}\left[(1 - \cos n\pi) - \dfrac{1}{2n}\left\{(n + 1)\cos\,(n - 1)\left(\dfrac{\pi}{2} - \alpha\right)\right.\right. \\
\qquad\qquad\qquad\qquad\qquad\qquad \left.\left. + \,(n - 1)\cos\,(n + 1)\left(\dfrac{\pi}{2} - \alpha\right)\right\}\right] \\
\text{which} = 0 \text{ when } n \text{ is odd.}
\end{array}\right\} \quad (1)$$

E is the amplitude of the parent sine wave and α is the angle shown in Fig. 2.

A simple analysis of the complete oscillator can be based on the coefficient A_1. If a sinusoidal signal of frequency $\omega_0/2\pi$ is attenuated z times by the discriminating circuit (from B to C) and z is less than n_0, oscillations of frequency $\omega_0/2\pi$ will build up; distortion of the output waveform will occur and increase until α has the value which satisfies the relationship

$$z = \frac{n_0}{\pi}(\pi - \alpha + \sin\alpha\cos\alpha) \qquad \ldots \quad (2)$$

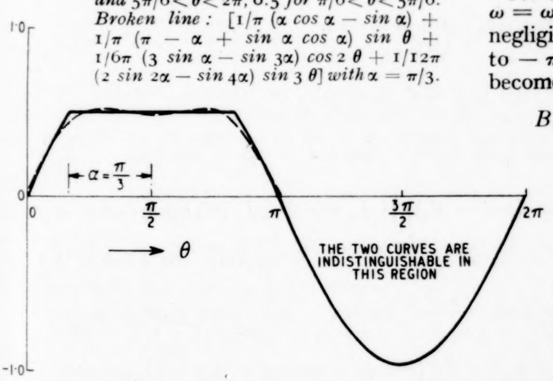
when equilibrium will be reached; clearly here $z = z'$. The inadequacy of this analysis will now be shown.

3. Derivation of Oscillator Characteristics

3.1 *Frequency of Oscillation.*

The derivation of the frequency, amplitude and harmonic content of the oscillation is here carried out with the complete circuit regarded as a loop, earth being one of the two terminals at every stage; all a.c. potentials will be expressed with respect to earth. The method resembles that used by Nyquist[10] when he considered the problem of the stability of degenerated amplifiers.

Fig. 3. *Full line: sin* θ *for* $0 < \theta < \pi/6$ *and* $5\pi/6 < \theta < 2\pi$, 0.5 *for* $\pi/6 < \theta < 5\pi/6$. *Broken line:* $[1/\pi\,(\alpha\cos\alpha - \sin\alpha) + 1/\pi\,(\pi - \alpha + \sin\alpha\cos\alpha)\sin\theta + 1/6\pi\,(3\sin\alpha - \sin 3\alpha)\cos 2\theta + 1/12\pi\,(2\sin 2\alpha - \sin 4\alpha)\sin 3\theta]$ *with* $\alpha = \pi/3$.



Suppose the loop is left uncompleted at some point (e.g., B Fig. 1), thereby preventing oscillations from occurring. The steady state of oscillation can then be found, even without closing the break, in the following way. Terminate the right-hand side of the break with an impedance Z, equal to that measured across the other—the left-hand—side of the break (here known as the input of the broken loop), and across the left-hand side connect a signal generator of controllable fundamental frequency, waveform and amplitude and of low impedance. Then when a signal voltage is found which is reproduced across Z in all respects, it is that which would appear at that point were Z and the generator removed and the break closed.

As a first step towards finding this complex signal, that signal produced by the amplifier when overloaded by a large-valued sinusoidal input of frequency $\omega/2\pi$ will be assumed to be fed to the input of the break. With the origin of the time scale suitably chosen this signal can be written

$${}_1V_B = A_1 \sin\omega t + B_2 \cos 2\omega t + A_3 \sin 3\omega t,$$

where A_1, B_2 and A_3 have the values given by Equ. (1). The d.c. component and the terms involving $n\omega t$ for $n > 3$ have been ignored. (Fig. 3 shows the effect of ignoring the terms above $3\,\omega t$ when there is severe overloading).

This signal gives rise to one, V_C, at C where

$$V_C = A_1' \sin(\omega t + \phi_1) + B_2' (\cos 2\omega t + \phi_2) + A_3' \sin(3\omega t + \phi_3).$$

If $|(\omega - \omega_0)/\omega_0| \ll 1$ and $R_1 \gg \omega LQ$, ϕ_1 is given by $\dfrac{\omega - \omega_0}{\omega_0} = -\dfrac{\phi_1}{2Q}$ and the ratio A_1'/A_1 differs from that which applies when $\omega = \omega_0$, namely $1/z'$, to an extent which is negligible here. ϕ_2 and ϕ_3 each approximate to $-\pi/2$, more and more closely as z' and Q become higher.

$$B_2' = \frac{2B_2}{3(z' - 1)Q} \text{ and } A_3' = \frac{3A_3}{8(z' - 1)Q}$$

Writing $B_2'/A_1' = C_2$ and $A_3'/A_1' = C_3$, V_C reduces to

$$A_1'\{\sin(\omega t + \phi_1) + C_2 \sin 2\omega t - C_3 \cos 3\omega t\}.$$

V_C is in turn amplified by A, the resultant signal n_0V_C being limited if, during the positive half-cycle of the fundamental frequency, it exceeds a value, say, $n_0A_1' \cos\alpha_1$. (This does not mean that limiting begins exactly at time $(\pi/2 - \alpha_1)/\omega$, because the presence of the harmonics nearly always modifies the time at which the total signal has the amplitude $+ n_0A_1' \cos\alpha_1$; knowledge of the time difference is not necessary here).

The essential feature of this analysis lies in expressing fully the result of this limiting action for which there is no known Fourier expression. The action can, however, be reduced to a simple form of non-linearity, for dealing with which several methods have been proposed. Of these, that used by Cooper[11] deals adequately and yet in a simple way with the problem. In this method the positive half-wave rectification of a signal V, whose modulus must, however, never exceed π, is shown to produce a signal

$$\frac{V}{2} + \frac{2}{\pi} V \sum_{1}^{\infty} \frac{1}{m} \sin mV, \text{ where } m \text{ is odd only} \quad \ldots \quad (3)$$

The signal at the output of A, ${}_0V_B$, can be expressed as

$$n_0 A_1'[\cos \alpha_1 - \{\cos \alpha_1 - \sin(\omega t + \phi_1) - C_2 \sin 2\omega t + C_3 \cos 3\omega t\}]$$

subject to the condition that

$$\{\cos \alpha_1 - \sin(\omega t + \phi_1) - C_2 \sin 2\omega t + C_3 \cos 3\omega t\}$$

be taken as zero whenever its value is negative. Now $|\cos \alpha_1 - \sin(\omega t + \phi_1)|$ can never exceed 2 and C_2 and C_3 are both $\ll 1$. Hence an expression for the signal obtained by the perfect half-wave rectification of $\{\cos \alpha_1 - \sin(\omega t + \phi) - C_2 \sin 2\omega t + C_3 \cos 3\omega t\}$ can be obtained by substituting this quantity for V in (3). Moreover because, from arguments based on physical grounds, the products of the half-wave rectification of kV are k times those of the half-wave rectification of V, the signal ${}_0V_B$ can be written

$${}_0V_B = n_0 A_1' \left[\cos \alpha_1 - \left\{\frac{V}{2} + \frac{2}{\pi} V \sum_{1}^{\infty} \frac{1}{m} \sin mV\right\}\right] \text{ where } m \text{ is odd only.}$$

Ignoring the term $n_0 A_1' \cos \alpha_1$ here, since it is a d.c. component only,

$$-\frac{\pi}{2}\left(\frac{{}_0V_B}{n_0 A'_1} + \frac{V}{2}\right) = V \sum \frac{1}{m} \sin mV = VW, \text{ say.}$$

If it is remembered that the important terms in VW are those involving the circular functions of ωt, $2\omega t$ and $3\omega t$, and that C_2 and C_3 are small, W can be written as

$$\sum_{1}^{\infty} \left[\left\{\frac{x_m}{m} - y_m (C_2 \sin 2\omega t - C_3 \cos \omega t)\right\} \cos\{m \sin(\omega t + \phi_1)\} - \left\{x_m (C_2 \sin 2\omega t - C_3 \cos 3\omega t) + \frac{y_m}{m}\right\} \sin\{m \sin(\omega t + \phi_1)\}\right]$$

where $x_m = \sin(m \cos \alpha_1)$, $y_m = \cos(m \cos \alpha_1)$ and m is odd.

Hence $VW =$

$$\sum_{1}^{\propto} \left[\frac{x_m}{m}\left\{\cos \alpha_1 - \sin(\omega t + \phi_1) - C_2 \sin 2\omega t + C_3 \cos 3\omega t\right\} - y_m \cos \alpha_1 (C_2 \sin 2\omega t - C_3 \cos 3\omega t) + \frac{y_m C_2}{2}\left\{\cos(\omega t - \phi_1) - \cos(3\omega t + \phi_1)\right\} - \frac{y_m C_3}{2}\left\{\sin(4\omega t + \phi_1) - \sin(2\omega t - \phi_1)\right\}\right]\left[J_0(m) + 2J_2(m) \cos 2(\omega t + \phi_1) + 2J_4(m) \,.\, \cos 4(\omega t + \phi_1) \ldots\right]$$

$$-\sum_{1}^{\infty} \left[x_m \cos \alpha_1 (C_2 \sin 2\omega t - C_3 \cos 3\omega t) - \frac{x_m C_2}{2}\left\{\cos(\omega t - \phi_1) - \cos(3\omega t + \phi_1)\right\} + \frac{x_m C_3}{2}\left\{\sin(4\omega t + \phi_1) - \sin(2\omega t - \phi_1)\right\} + \frac{y_m}{m}\left\{\cos \alpha_1 - \sin(\omega t + \phi_1) - C_2 \sin 2\omega t + C_3 \cos 3\omega t\right\}\right]\left[2J_1(m) \,.\, \sin(\omega t + \phi_1) + 2J_3(m) \,.\, \sin 3(\omega t + \phi_1) + 2J_5(m) \sin 5(\omega t + \phi_1) \ldots\right]$$

where $J_n(m)$ are Bessel functions of the first kind of order n.

$\frac{{}_0V_B'}{n_0 A_1}$ then reduces to the following important terms

$$\tfrac{1}{2} + \frac{2}{\pi}\left[\sum_{1}^{\infty}\left\{\frac{x_m}{m}\Big(J_0(m) - J_2(m)\Big) + 2\frac{y_m}{m} \cos \alpha_1 \,.\, J_1(m)\right\}\right] \sin(\omega t + \phi_1) \quad \ldots \quad \ldots \quad (4),$$

terms in $\cos(\omega t \pm p\phi_1)$, p being an integer 1–4, which terms may be written with sufficient accuracy, because $\sin \phi_1$ is small, as

$$-\frac{2}{\pi}\Big[\sum_1^\infty C_2\Big\{\frac{y_m}{2}\Big(J_0(m)-J_4(m)\Big)-\Big(x_m\cos\alpha_1-\frac{y_m}{m}\Big)\Big(J_1(m)+J_3(m)\Big)\Big\}$$

$$+C_3\Big\{\Big(\frac{x_m}{m}+y_m\cos\alpha_1\Big)\Big(J_2(m)+J_4(m)\Big)+\frac{x_m}{2}\Big(J_1(m)-J_5(m)\Big)\Big\}\Big]\cos\omega t \quad .. \quad .. \quad (5)$$

$$-\frac{2}{\pi}\Big[\sum_1^\infty\Big\{\Big(2\frac{x_m}{m}\cos\alpha_1 . J_2(m)-\frac{y_m}{m}\Big(J_1(m)-J_3(m)\Big)\Big\}\Big]\cos(2\omega t+2\phi_1) \quad .. \quad .. \quad (6)$$

and

$$\frac{2}{\pi}\Big[\sum_1^\infty\Big\{\frac{x_m}{m}\Big(J_2(m)-J_4(m)\Big)+2\frac{y_m}{m}\cos\alpha_1 . J_3(m)\Big\}\Big]\sin(3\omega t+3\phi_1) \quad .. \quad .. \quad .. \quad (7)$$

The terms (4), (6) and (7) contain neither C_2 nor C_3 and are identical with those which would be obtained by overloading the amplifier with a sinusoidal signal of the type $\sin(\omega t+\phi_1)$ of such a magnitude that overloading would occur at the angle α_1. Hence it follows that $\frac{1}{\pi}\Big(\pi-\alpha_1+\sin\alpha_1 . \cos\alpha_1\Big)=\frac{1}{2}$

$$+\frac{2}{\pi}\sum_1^\infty\Big\{\frac{x_m}{m}\Big(J_0(m)-J_2(m)\Big)$$

$$+\frac{2y_m}{m}\cos\alpha_1 . J_1(m)\Big\},$$

where m is odd only, the L.H.S. having been derived from the Fourier coefficient A_1; this identity can be derived otherwise (see Appendix).

It is now necessary to reconcile ${}_0V_B$ with ${}_1V_B$, and if, as a first step, the respective amplitudes of the terms in ωt are to be made equal, α_1 must equal α (the term (5) has no significant influence on the magnitude of the resultant term in ωt). The relationship (2) follows and

$$\frac{n_0A_1'}{\pi}(\pi-\alpha+\sin\alpha\cos\alpha)=A_1.$$

It follows that the amplitude of term (6) is B_2 and that of (7) is A_3; thus

$$B_2=-\frac{2n_0A_1'}{\pi}\Big[\sum_1^\infty\Big\{2\frac{x_m}{m}\cos\alpha . J_2(m)-\frac{y_m}{m}\Big(J_1(m)-J_3(m)\Big)\Big\}\Big] \text{ and}$$

$$A_3=\frac{2n_0A_1'}{\pi}\Big[\sum_1^\infty\Big\{\frac{x_m}{m}\Big(J_2(m)-J_4(m)\Big)+\frac{2y_m}{m}\cos\alpha . J_3(m)\Big\}\Big] \text{ where } m \text{ is odd only.}$$

Term (5) was ignored as far as its effect on the amplitude of the net component in ωt was concerned. But it has an influence on the *phase* of this component of ${}_0V_B$ which can be written as $A_1\sin(\omega t+\phi_1-\theta)$ where, because θ is small,

$$\theta=\frac{2n_0A_1'}{\pi A_1}\Big[\sum_1^\infty C_2\Big\{\frac{y_m}{2}\Big(J_0(m)-J_4(m)\Big)-\Big(x_m\cos\alpha-\frac{y_m}{m}\Big)\Big(J_1(m)+J_3(m)\Big)\Big\}+$$

$$C_3\Big\{\Big(\frac{x_m}{m}+y_m\cos\alpha\Big)\Big(J_2(m)+J_4(m)\Big)+\frac{x_m}{2}\Big(J_1(m)-J_5(m)\Big)\Big\}\Big] \text{ where } m \text{ is odd only.}$$

The coefficient of C_2 in this term is

$$\frac{2n_0A_1'}{\pi A_1}\sum_1^\infty\Big\{\frac{y_m}{2}\Big(J_0(m)-J_4(m)\Big)-\Big(x_m\cos\alpha-\frac{y_m}{m}\Big)\Big(J_1(m)+J_3(m)\Big)\Big\} \text{ which, remembering}$$

that $J_n(m)+J_{n+2}(m)=\frac{2(n+1)}{m}J_{n+1}(m)$, reduces to

$$\frac{4n_0A_1'}{\pi A_1}\sum_1^\infty\Big\{\frac{y_m}{m}\Big(J_1(m)-J_3(m)\Big)-\frac{2x_m}{m}\cos\alpha . J_2(m)\Big\}=\frac{2B_2}{A_1}.$$

Similarly the coefficient of C_3, $\frac{2n_0A_1'}{\pi A_1}\Big[\sum_1^\infty\Big\{\Big(\frac{x_m}{m}+y_m\cos\alpha\Big)\Big(J_2(m)+J_4(m)\Big)+$

$\frac{x_m}{2}\Big(J_1(m)-J_5(m)\Big)\Big\}\Big]$ can be shown to be $\frac{3A_3}{A_1}$.

Hence $\theta=\frac{2B_2C_2+3A_3C_3}{A_1}$. If the phases of the fundamental components of ${}_0V_B$ and ${}_1V_B$

are to be identical, $\phi_1 = \theta$. This relationship immediately determines ω; for

$$\frac{\omega - \omega_0}{\omega_0} = -\frac{1}{2Q}\left(\frac{2B_2C_2 + 3A_3C_3}{A_1}\right).$$

Because $\dfrac{2B_2}{QA_1} = 3\,\dfrac{(z' - 1)}{z'}\left(\dfrac{2B_2z'}{3(z' - 1)QA_1}\right)$,

$$\frac{3A_3}{QA_1} = \frac{8(z' - 1)}{z'}\left(\frac{3A_3z'}{8(z' - 1)QA_1}\right)$$

and $(z' - 1)/z'$ may be taken as unity,†

$$\frac{\omega - \omega_0}{\omega_0} = -\tfrac{1}{2}(3C_2^2 + 8C_3^2).$$

Moreover it is not difficult to show that if additional terms are included in the expression for ${}_1V_B$, the nth harmonic contributes a term $-\frac{1}{2}(n^2 - 1)C_n^2$ to $(\omega - \omega_0)/\omega_0$. The more general result is therefore

$$\frac{\omega - \omega_0}{\omega_0} = -\tfrac{1}{2}[3C_2 + 8C_3^2 + \;.\;.\;.\;.\;. \\ + (n^2 - 1)C_n^2 \;.\;.\;.\;];$$

this is Groszkowski's relationship.

The phases of the harmonics present in ${}_0V_B$ and ${}_1V_B$ remain to be compared. The small discrepancy which is found is due mainly to the exclusion of certain small-valued terms from expressions (6) and (7) and to harmonics above the third having been ignored. No further consideration will be given to this less important feature.

3.2 *Other Characteristics*

Other characteristics of importance to a designer of an oscillator of this type are easily calculable from the analysis of Section 3.1. Assuming that n_0, L, Q and ω_0 are known, as is normal, Fig. 4 offers the designer most of these other properties in terms of n_0/z, which can be calculated from these primary quantities and R_1, a quantity at the designer's disposal. For this figure α [from Equ. (2)], B_2/A_1, A_3/A_1 and $\dfrac{\omega - \omega_0}{\omega_0}$ have been determined in turn. But $(\omega - \omega_0)/\omega_0$ itself is rarely of importance because (*a*) only a very exact knowledge of L, Q, C_0, the stray capacitances associated with the resonant circuit and with the leads to the amplifier, etc., will reduce the error in calculating ω_0 to less than $(\omega - \omega_0)$ and (*b*) some control of ω_0, if only in the form of a trimming capacitor shunted across C_0, is usually fitted. Whereas however the error in calculating ω_0 is not a function either of the power supplies (provided the inductor L is not iron-cored) or of any changes in the emissivity of the cathodes of V_1 and V_2 (except in each case so far as the input capacitance of A is

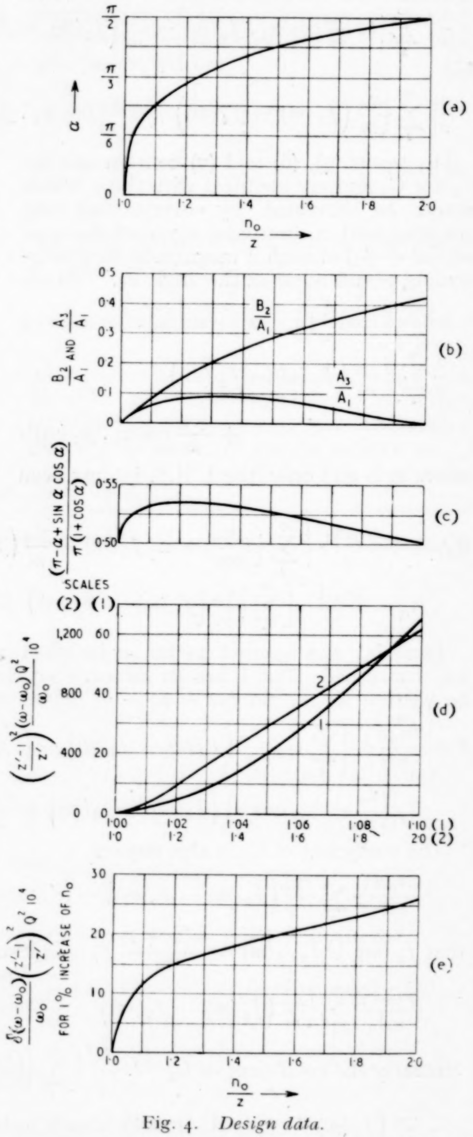


Fig. 4. *Design data.*

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† If conditions are such that $(z' - 1)/z'$ is thought to be significantly different from unity, allowance must then be made for ϕ_1, under these conditions, being slightly different from $-2Q\left(\dfrac{\omega - \omega_0}{\omega_0}\right)$. The final result for $\left(\dfrac{\omega - \omega_0}{\omega_0}\right)$ is unaffected.

concerned), $(\omega - \omega_0)/\omega_0$, being a function of n_0, clearly is. The fractional change of n_0 accompanying any given fractional change of supply voltage will be a function of certain properties of the valves and of the extent of degeneration of A. Elsewhere the author[9] has suggested the following relationship for the change of mutual conductance, g, of an r.f. pentode used with cathode bias (suitably bypassed by a large value capacitor) and without a " dropping " resistor in the screen-grid circuit :— $\frac{\delta g}{g} \leqslant 0.5\frac{\delta V_{G2}}{V_{G2}} + 0.3\frac{\delta V_H}{V_H}$, V_{G2} and V_H being the screen-grid and heater voltages respectively. It is assumed here that any change in V_H persists for a time long compared with the thermal time constant of the cathode. If the screen grid receives its voltage from the h.t. supply, V_B, via a resistor, as is common, $\frac{\delta V_{G2}}{V_{G2}} < \frac{\delta V_B}{V_B}$. Now the amplifier A uses two such valves, in the cathode circuit of each of which the lack of bypassing capacitors produces about 6-db local feedback for each stage, and its overall gain has been degenerated n_1 times to n_0. Hence it can be shown that $\frac{\delta n_0}{n_0} < \frac{1}{n_1}\left(0.5\frac{\delta V_B}{V_B} + 0.3\frac{\delta V_H}{V_H}\right)$. If both V_B and V_H are derived from a common supply, V_S, and $\frac{\delta V_B}{V_B} = \frac{\delta V_H}{V_H} = \frac{\delta V_S}{V_S}$, $\frac{\delta n_0}{n_0} < \frac{0.8}{n_1} \cdot \frac{\delta V_S}{V_S}$; i.e., a change of $\frac{n_1}{0.8}$ % of V_S causes less than a 1% change of n_0. The curve (*e*) has therefore been added to Fig. 4. It shows the changes of $\frac{\omega - \omega_0}{\omega_0}$, which are those of $\frac{\omega}{\omega_0}$, resulting from a 1% change of n_0. If $n_1 = 8$, $Q = 100$, $\frac{n_0}{z} = 1.2$ and $z (= z')$ is large a 1% change of V_S causes $< 1.5 \,.\, 10^{-8}$ parts change in ω/ω_0, which represents good stability.

Little of a definite nature can be said of the short-period irregularities in cathode emission of modern valves except that they rarely result in changes of g greater than those accompanying a 2% change of heater voltage.

The changes of interelectrode capacitances affect ω_0 and hence ω; in practice the input capacitance, C_A, of A is, in this respect, of far greater importance than the output capacitance. The important components of C_A are, that due to the dynamic capacitance, C_{g1-k}, between the control grid and cathode of V_1; that between the control grid and the screen grid, C_{g1-g2}, of V_1; and the capacirance, C_s, between this control grid and the heater and metallizing of V_1. C_{g1-k} is a function of cathode current[12]; hence it is a function of the supply voltage. For such valves as the SP41, EF50 and EF36 used as V_1 in Fig. 1 it would be safe to assume that a 10% change of V_S causes no more than a small fraction of 1pF change in the value of C_{g1-k}. But C_{g1-k} is clearly within the overall feedback path, and any change in it will appear appropriately reduced at the input of A. C_{g1-g2} is not so included, though by a simple modification of the circuit of V_1 it can be made so; it is however much less dependent on V_S than is C_{g1-k}. V_S has no effect on C_s other than that caused by change of the temperature and hence of the linear dimensions of the various grids, etc.

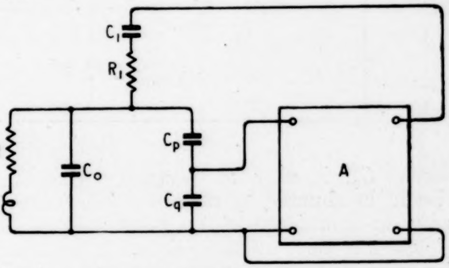


Fig. 5. *Alternative coupling of the discriminating circuit to the amplifier.*

But these considerations of the effect of C_A on ω apply only when the degree of overloading of A is negligibly small; for during that fraction of the period when overloading is taking place, the overall degeneration disappears, though the smaller degree of local degeneration of V_1 remains. If C_A is included in C_0, this larger capacitance clearly has two values, one during that part of the cycle when the main degeneration is operative and a second, greater, value, when it is not. However, there are methods of reducing the contribution which C_A makes to C_0 which ensure also that changes in this contribution occurring when the extent of overloading changes, as a result say of variations of the supply voltage, are made very small. The resonant circuit can be coupled to the input of A by means of a capacitive potential divider (C_p, C_q), attenuating all signals $n_c = \dfrac{C_p}{C_p + C_q}$ times, as shown in Fig. 5, C_0 being suitably reduced to maintain ω_0 unchanged. R_1 must be readjusted so that $\dfrac{R_1 + \omega_0 L'Q}{\omega_0 L'Q} = z' = \dfrac{z}{n_c}$. The influence of changes of C_A on the value of ω is then reduced $n_c{}^2$ times. Because a grid leak resistor for V_1 must be shunted across C_q, it may be necessary that C_p should be shunted by a resistor (n_c–1) times as great in order that this potential divider should introduce no phase shift. In practice, however, the phase shift resulting from the omission of this second resistor is usually so small that, although admittedly causing a change (usually very small) of ω, the effect on $\dfrac{\delta\omega}{\omega_0} \cdot \dfrac{V_S}{\delta V_S}$, the more important quantity for most purposes, is negligible. A resistance potential divider can sometimes be used in place of C_p and C_q; it makes a much smaller contribution to the tuning capacitance but degrades the Q of the resonant circuit. If either modification is made, the distinction between z and z' must be observed.

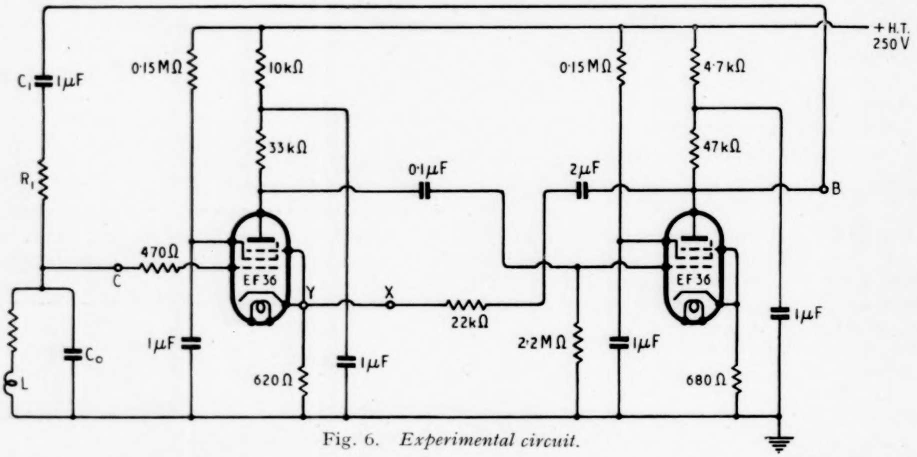


Fig. 6. *Experimental circuit.*

No calculation of the absolute magnitude of the signal at any point in the loop was necessary in the analysis of Section 3.1. But the designer of an oscillator may need information on this point. It can be obtained as follows. The excursion of the control grid of V_2 is from cut off or beyond to the onset of grid current, i_G; the anode current, therefore, varies from zero to the value, i_0, which it has at the onset[‡] of i_G for the particular value of V_{G2}. From the appropriate expression for the output waveform, $E \sin \omega t$ limited at one extremity, it follows that $E + E \cos\alpha = i_0 R_{L2}$ where R_{L2} is the net anode load of V_2. Hence $E = i_0 R_{L2}/(1 + \cos\alpha)$ and $A_1 = \dfrac{i_0 R_{L2}(\pi - \alpha + \sin\alpha\cos\alpha)}{\pi(1 + \cos\alpha)}$. The signal which should be used, that at the control grid of V_1, has an amplitude A_1/z. Fig. 4 includes a curve of $\dfrac{(\pi - \alpha + \sin\alpha\cos\alpha)}{\pi(1 + \cos\alpha)}$ against $\dfrac{n_0}{z}$.

4. Experimental Confirmation

Confirmation of the results given by the preceding analysis was desirable. Many data could have been taken from the performance of several oscillators which had been constructed during the past six years using this circuit; but some desired data would have been missing or in unsuitable form. It was thought better therefore to concentrate on one new unit.

The circuit shown in Fig. 6 was set up. With X removed from Y and connected to earth the voltage gain of the amplifier from C to B, over the frequency range 1 — 10 kc/s, was 255; with the connection as shown (the condition to be assumed in all that follows) the gain was 29.8 ($= n_0$). The overall feedback was thus 8.5 times. The amplifier introduced negligible phase shift. L was an air-core inductor having a series inductance of 26.2 mH; its Q was artificially reduced to 10.0 ± 0.1 at the relevant frequency in order that $\frac{\omega - \omega_0}{\omega_0}$ should be the more easily observable. R_1 was controllable; hence z was calculable.

[‡] Because the control grid current increases very rapidly with small changes in the positive direction of the potential of this grid once the critical potential has been reached, the influence on i_0 of these small changes is negligible, and i_0 is assumed independent of $\frac{n_0}{z}$; e.g., in Fig. 2.

The measuring instruments used had input impedances sufficiently high to ensure that their connection to any point of the oscillator had negligible influence on the results obtained. The waveform of the signal at B is shown in Fig. 7. A condition of moderate overloading ($R_1 = 107\ \text{k}\Omega$, $n_0/z = 1.06$, $\alpha \approx \pi/6$) yielded (*a*), and one of severe overloading ($R_1 = 56.3\ \text{k}\Omega$, $n_0/z \approx 2$, $\alpha \approx \pi/2$) gave (*b*). The shape of (*a*) shows no measurable deviation from the waveform expected from the description, given in Section 2.22, of the mechanism of overloading; that of (*b*) shows a slight deviation from the constant limiting expected during the relevant half cycle and shows just perceptible distortion at the other extremity of the signal. The measurements of α, harmonic content at B and frequency of oscillation made for five values of R_1 are given in Table 1 together with values deduced, for the appropriate values of n_0/z, from Fig. 4.

TABLE I

Measured								Calculated			
R_1 (kΩ)	z	n_0/z	α *	B_2/A_1	A_3/A_1	$\omega/2\pi$ (c/s)	$\frac{(\omega - \omega_0)}{\omega_0} . 10^4$	α	B_2/A_1	A_3/A_1	$\frac{(\omega - \omega_0)}{\omega_0} . 10^4$
114.6	29.7	1.00	0	<.005	0	$2404.5_0 \pm 0.0_3$	0	0	0	0	0
107.0	27.8	1.06	$\pi/6$	0.06	0.04	$2404.3_7 \pm 0.0_3$	0.5	37°	0.05_5	0.04	0.3
101.8	26.5	1.11	$\pi/4$	0.09	0.065	$2404.2_5 \pm 0.0_3$	1.0	46°	0.10	0.065	0.8
89.3	23.4	1.27	$\pi/3$	0.17	0.09	$2403.8_7 \pm 0.0_6$	2.6	62°	0.19	0.09	3.0
56.3	15.1	1.96	$\pi/2$	0.40	0.02	$2401.3_7 \pm 0.0_6$	13.0	89°	0.41	0.01	13.2

* Nominal value only.

Had C_1 been made infinitely large the values of $\omega/2\pi$ recorded would have been smaller by amounts varying from 0.07 (for $R_1 = 114.6$) to 0.13 ($R_1 = 56.3$); the resulting changes to the measured values of $\frac{\omega - \omega_0}{\omega_0} . 10^4$ are hardly of any significance; thus 13.0 would read 13.3 and 2.6 would read 2.7. Agreement between the measured and calculated sets of values in Table 1 is good.

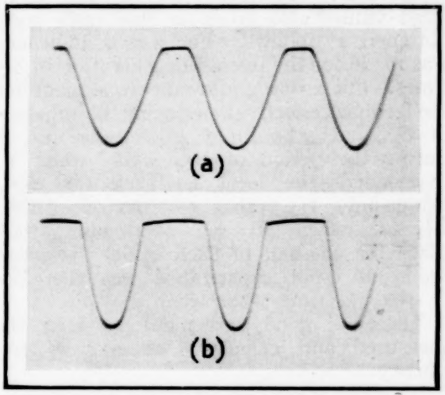


Fig. 7. *Waveforms obtained at the output of the drive circuit.*

The measured magnitude of the signal occurring at the output of the driving amplifier, when $R_1 = 56.3\ \text{k}\Omega$ ($\alpha \approx \pi/2$) corresponded to an overall change of anode current of V_2 of 7.0 mA. Static characteristics of the valve showed that an anode current of 7.0 mA occurred for a control grid to cathode potential, V_{g1-k}, of $-$ 0.4 V for the relevant value of the screen voltage; grid current was $\approx$ 1μA for $V_{g1-k} = -$ 0.7 V and $\approx$ 10μA for $-$ 0.4 V.

Measurements of $\frac{\delta\omega}{\omega_0}\Big/\frac{\delta V_s}{V_s}$ were not possible; $\delta\omega$ was too small to be measurable with the equipment used for values of $\left|\frac{\delta V_s}{V_s}\right|$ up to 0.25 and little interest would attach to any measurements for which $\left|\frac{\delta V_S}{V_S}\right| > 0.25$.

A capacitor C_3, placed between the control grid and cathode of V_1 affected the frequency to the extent shown in Table 2. The calculated values also given in this table were obtained as follows. For $\alpha \approx 0$ allowance was made for the overall degeneration of 8.5 times. For $\alpha = \pi/2$ allowance was made for the feedback effective in reducing the influence of C_{g1-k} on the input capacitance of A during the period of each cycle when V_2 overloaded—the local feedback for V_1—being only 1/4.5 that effective elsewhere. Because when $\alpha = \pi/2$ overloading took place for one-half of each cycle, the mean value of input capacitance was therefore $(1 + 4.5)/2$ times that when $\alpha = 0$.

There is good agreement between the measured and calculated changes of frequency.

TABLE II

Condition	$0<\alpha<5°$		$\alpha = \pi/2$	
C_3	1,000 pF	10,000 pF	1,000 pF	10,000 pF
$\frac{\delta\omega}{\omega_0}$ measured	$-3.6 \cdot 10^{-4}$	$-3.7 \cdot 10^{-3}$	$-8.9 \cdot 10^{-4}$	$-8.5 \cdot 10^{-3}$
$\frac{\delta\omega}{\omega_0}$ calculated	$-3.5 \cdot 10^{-4}$	$-3.5 \cdot 10^{-3}$	$-9.5 \cdot 10^{-4}$	$-9.5 \cdot 10^{-3}$

5. Discussion

The present analysis, based on physical arguments derived from loop considerations, differs widely from earlier full analyses of oscillator circuits. The main feature is the calculation of the phase change introduced by the amplifier forming the driving circuit when both the input signal contains harmonic components and limiting occurs. This has some novelty in that although calculations of the output products of circuits exhibiting non-linearity when fed with non-sinusoidal signals are common, they usually deal only with the amplitudes of the intermodulation products.

Amongst the results obtained one, of much importance, is consistent with Groszkowski's general relationship connecting the frequency of oscillation and harmonic content. But the analysis is no mere substitute for Groszkowski's in respect of this particular oscillator. It provides, in addition, for the type of oscillator discussed the data not deducible from Groszkowski's relationship necessary to give that relationship practical significance. Recourse to measurements of harmonic content and change of such content with change of supply voltage are unnecessary.

The practical merits of this oscillator can now be briefly discussed. Only those properties of the valves used which are normally specified are of importance here ; they do not involve the exact law of the curvature of the $I_A - V_{G1}$ characteristic, secondary emission, suppressor-grid characteristics or interelectrode capacitances (except in a secondary manner). Indeed it is for this reason that an estimation was possible of the behaviour to be expected from the oscillator when a small percentage change is made to the supply voltage. Even van der Pol[5], in his analysis of the regenerative triode oscillator, made no attempt to predict this behaviour ; yet it is of much interest to the designer requiring high stability of frequency. There is great flexibility in the driving circuit ; it is easily adapted for circuits with extreme values of L/C, and for frequencies up to several Mc/s and down to a few c/s. The resonant circuit is a simple type ; mutual inductance is absent and the reactive component introduced by the driving circuit is easily made much smaller than is possible with some other oscillators. The harmonic content of the signal at C will normally be $<0.3\%$ if $Q \geqslant 50$, so that a buffer amplifier connected to receive some or all of the signal at this point will then provide anout put signal whose waveform will be substantially sinusoidal.

Pentodes are specified in preference to triodes for the amplifier A ; the more so for oscillators designed for frequencies above about 10 kc/s. But the analysis would follow much the same lines even if triodes were substituted.

For fixed frequency oscillators $(n_0/z - 1)$ should be made small (e.g., $\leqslant 0.05$) because frequency stability and harmonic content improve as $n_0/z \to 1$. But the risk of oscillations ceasing, should n_0 decrease slightly, accompanies a very close approach to the condition $n_0/z = 1$. A more important use of the LC oscillator is as a variable frequency oscillator; in which C or, in the case of multi-range units, both C and L can be controlled. Because it is highly improbable that, with the simple resonating circuit, R' will remain constant as C is varied, it is most desirable that the properties of the oscillator should not suffer unduly from the lack of a control of the driving circuit which maintains the oscillating condition close to the critical state (corresponding here to $(n_0/z - 1) \to 0$). But designers rarely find it easy to include this control in the way usually preferred by the user, namely coupled to the control of frequency.

With the present oscillator the increase of $\frac{\Delta\omega}{\omega_0}$ per 1% change of V_S, which quantity will be denoted Δ, from say $n_0/z = 1.1$ to $n_0/z = 2.0$ is 2.5 times if Q is assumed constant. This may be tolerable for most purposes, particularly because the absolute values of Δ can normally be made very small; any control of z or n_0 aimed at maintaining n_0/z constant at, say, 1.1 is therefore unnecessary. But some change of A_1' must be expected over the range. Even if R' remains substantially constant—or the resonant circuit is elaborated deliberately[13] with the view to maintaining the equivalent R' constant—over the frequency range controlled by the variable capacitor C, the important properties will vary over the range, despite the constancy of n_0/z, because Q must then vary roughly as $1/\omega_0$; but once again the properties may well be satisfactory.

At first sight there may seem considerable resemblance between the present oscillator and the Franklin[14] type (see Fig. 8), in that a two-valve unit is used, the coupling is from the anode of the second valve to the grid of the first via high impedance(s) and the resonant circuit is of the simple LC type. But analysis of the Franklin circuit involves features which are foreign to or irrelevant in the analysis of Sections 3.1 and 3.2.

For consider the Franklin oscillator to be in the condition of just maintaining oscillations (i.e., the harmonic content small), and refer the phases of all signals to that of the voltage between the control grid of V_1 and earth, neglecting multiples of 2π. Now it can be assumed, as Ladner and Stoner[15] state, that the phase change introduced by V_1 is the conventional π. The phase of the current flowing into the resonant circuit will therefore lead the voltage at the anode of V_2 by $\pi/2$ because C_2 has an impedance very high compared with those of other relevant components. If, therefore, the phase of this anode voltage is $3\pi/2$ (i.e., only $\pi/2$ ahead of that of the grid voltage of V_2), the current flowing into the resonant circuit will have zero phase angle. Provided the input impedance of V_1 is purely capacitive the phase of the voltage across the resonant circuit must coincide with that of the current producing it; i.e., the oscillation frequency $\omega/2\pi$ will be the resonant frequency, $\frac{\omega_0}{2\pi}$.

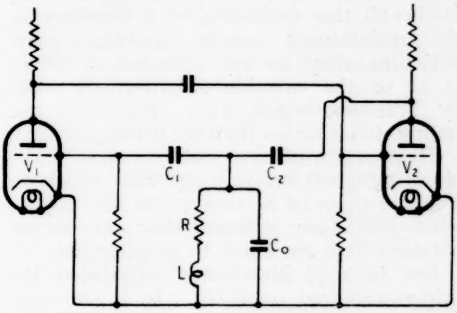


Fig. 8. *Basic circuit of Franklin oscillator.*

But the patent specification suggests that the anode load of V_2 is more nearly resistive than capacitive; and it seems doubtful whether the input of V_1 can be assumed purely capacitive. These two features demand that the phase of the voltage across the resonant circuit should lag behind the current producing it. Good designs of oscillator avoid any large difference of phase here, because it is detrimental to frequency stability and, of less importance, it causes $\omega/2\pi$ to differ from $\omega_0/2\pi$.

The fact that the impedance coupling the output of V_2 to the resonant circuit is capacitive rather than resistive may be seriously detrimental in that the harmonic currents fed to the resonant circuit will be relatively enhanced.

If the input capacitance of V_1 plays any substantial part in determining the input impedance of the amplifier, as seems most likely, the objection can be raised that gain or level considerations in this unit are dependent on a component that will vary with changes of supply voltage and ageing of the valve.

Franklin designed his oscillator before degeneration and its advantages were understood; the lack of this feature in the earlier oscillator represents a very important distinction between the two driving circuits. (Although this discussion of a sixteen-year old maintaining circuit contains some criticisms, they are not intended to reflect at all on the valuable contributions made by Franklin, which have resided in the tuning circuit rather than the driving circuit).

There are insufficient data for Δ for oscillators designed before 1938 with which to compare those of Section 3.2 in any detail; what there are indicate that the values obtained here are much to be preferred.

But in 1938 Meacham[16] introduced the bridge-stabilized oscillator. In it the non-linear resistance of a filament lamp forms one arm of a resistance bridge and controls the amplitude of oscillation. Correctly used, his circuit ensures that a very close approximation is made to the critical condition of exact neutralization, mentioned in Section 1 as being of little practical importance to the early investigators. Moreover, bridge stabilization maintains this condition of oscillation almost unchanged when valves age or supply voltages change. Extremely good stability of frequency is therefore expected and, in fact, obtained. Meacham shows that for an oscillator having his drive unit and a quartz crystal resonator ($Q = 100{,}000$) a 10 % change of gain (nominally 400 times) of his single valve amplifier gives $\Delta\omega/\omega = 2 \times 10^{-9}$ when the phase change through the amplifier is 0.1 radian. This figure for $\Delta\omega/\omega$ becomes 2×10^{-11} if a 1 % change of gain (such as would be obtained with a change of ≈ 1 % of V_s) and a phase shift of 0.01, which despite the transformers involved need not necessarily be exceeded with good design at any one frequency, are substituted. Contrast this figure with that of 2×10^{-14}, which reference to Fig. 4(e) shows is possible for the same change of V_s with the present oscillator (having $n_1 = 8$) and like resonator. But it is only fair to add that the stability of the Meacham oscillator is proportional to Q and not to Q^2. If a value of Q of 100 is substituted for that of 100,000 each oscillator offers values of Δ of about 2×10^{-8}.

Meacham's work rightly attracted much attention and has been extended. Thus Clifford[17] has recently designed a bridge-stabilized resistance-capacitance oscillator having a drive circuit differing from that of Meacham but retaining a lamp as the non-linear device. He gives data from which a figure for Δ of 1.10^{-5} is deducible. Bearing in mind the very low Q associated with his discriminating circuit, this figure represents a high order of stability. Mention must be made also of an oscillator designed by Terman, Buss, Hewlett and Cahill[8]. This uses an RC discriminating circuit and a drive circuit which differs from A of Fig. 1. in one significant respect only. A lamp replaces R_K. Once again the resistance of the lamp, which is here a function of the signal level at B, controls that important factor of this drive circuit, the gain of A, in such a direction and to the extent that exact neutralization is approached. There can be little doubt that the substitution of a lamp for R_K still further improves the drive circuit from the point of view of stability of frequency with ageing of the valves and changes of supply voltage.

6. Conclusions

The aims of this article are to analyse a particular oscillator on the basis of loop considerations, a method not previously fully explored, and to demonstrate the advantages of the oscillator. The analysis extends to all the features normally of interest to the designer and the results obtained are of a simple form. Quantitative results are given in graphical form.

A detailed comparison between the stability of frequency with changes of supply voltages obtainable with this oscillator and those of oscillators designed before the introduction of the use of non-linear elements such as lamps to stabilize the amplitude of oscillation, thereby limiting the harmonic production, was considered unnecessary; this feature of the performance of earlier circuits of comparable simplicity never approaches that deduced here.

Sufficient comparison has been made with the bridge-stabilized type of oscillator to show that for use with resonant circuits having magnifications of 100 or more the present type holds its own or does even better in respect of stability. Any difference here is, at the moment, largely of academic interest because the limitations on stability for either type are far more likely to be found in the important temperature coefficients, and ageing effects, of the resonator than with any feature of the driving circuits.

APPENDIX

I am indebted to P. J. Hilton of Queens College, Oxford, for the following proof that

$$\frac{\pi}{2} - \alpha + \sin\alpha\cos\alpha = 2\sum_{1}^{\infty}\left[\frac{\sin(m\cos\alpha)}{m}\left\{J_0(m) - J_2(m)\right\} + 2\,\frac{\cos(m\cos\alpha)}{m},\ \cos\alpha\,.\,J_1(m)\right]$$

where m is odd only.

It is included here primarily because the method of attack is applicable to other problems involving periodic functions and Bessel coefficients.

Consider a function $f_1(t)$ defined by $f_1(t) = (1 - t^2)^{-\frac{1}{2}}$ when $-1 < t < 1$, $f_1(t) = 0$ when $-\pi \leqslant t \leqslant -1$ and $1 \leqslant t \leqslant \pi$ and $f_1(t) = f_1(t + 2\pi)$. Then $f_1(t)$ may be expanded in a Fourier series and, since $f_1(t) = f_1(-t)$,

$$f_1(t) = \tfrac{1}{2}a_0 + \sum_{1}^{\infty} a_m \cos mt$$

$$\text{where } a_m = \frac{1}{\pi}\int_{-\pi}^{\pi} f_1(t)\cos mt\,dt$$

$$= \frac{1}{\pi}\int_{-1}^{1}(1 - t^2)^{-\frac{1}{2}}\cos mt\,.\,dt$$

$$= \frac{1}{\pi}\int_{-\pi/2}^{\pi/2}\cos(m\sin\theta)d\theta.$$

Hence $a_m = J_0(m)$ and $a_0 = 1$. Therefore $f_1(t) = \frac{1}{2} + \sum_{1}^{\infty} J_0(m)\,.\cos mt$. Put $t = \sin\alpha$; then $-1 < t < 1$ and $f_1(\sin\alpha) = (1 - \sin^2\alpha)^{-\frac{1}{2}} = \sec\alpha$.

$$\text{Therefore } \sec\alpha = \tfrac{1}{2} + \sum_{1}^{\infty} J_0(m)\cos(m\sin\alpha)\ \ldots \qquad (1)$$

Put $t = \pi - \sin\alpha$; then if $\sin\alpha > 0$, $1 \leqslant t \leqslant \pi$ and if $\sin\alpha < 0$, $-\pi \leqslant t - 2\pi \leqslant -1$. Hence $f_1(\pi - \sin\alpha)$ must always be zero.

$$\therefore\ \tfrac{1}{2} + \sum_{1}^{\infty}(-1)^m J_0(m)\cos(m\sin\alpha) = 0 \quad \ldots \qquad (2)$$

Subtracting (2) from (1) gives

$$\sec\alpha = 2\sum_{1}^{\infty} J_0(m)\cos(m\sin\alpha) \text{ where } m \text{ is odd only} \quad \ldots\ \ldots\ \ldots\ \ldots \qquad (3)$$

Consider now the function $f_2(t)$ defined by $f_2(t) = t(1 - t^2)^{-\frac{1}{2}}$ when $-1 < t < 1$, $f_2(t) = 0$ when $-\pi \leqslant t \leqslant -1$ and $1 \leqslant t \leqslant \pi$ and $f_2(t) = f_2(t + 2\pi)$. Then $f_2(t)$ may be expanded in a Fourier series, and since $f_2(t) = -f_2(-t)$

$$f_2(t) = \sum_{1}^{\infty} b_m \sin mt \text{ where } b_m = \frac{1}{\pi}\int_{-\pi}^{\pi} f_2(t)\sin mt\,dt$$

$$= \frac{1}{\pi}\int_{-1}^{1} t(1 - t^2)^{-\frac{1}{2}}\sin mt\,dt$$

$$= \frac{1}{\pi}\int_{-\pi/2}^{\pi/2}\sin\theta\,.\sin(m\sin\theta)\,d\theta = J_1(m).$$

Therefore $f_2(t) = \sum_{1}^{\infty} J_1(m)\sin mt$. Then the expressions obtained first when $\sin\alpha$ and second when $(\pi - \sin\alpha)$ are substituted for t enable the equation

$$\sin\alpha\sec\alpha = 2\sum_{1}^{\infty} J_1(m)\sin(m\sin\alpha) \text{ where } m \text{ is odd only} \quad \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots \qquad (4)$$

to be obtained. Because $\cos\alpha = \sec\alpha - \sin^2\alpha\sec\alpha$ it follows from (3) and (4) that

$$\cos\alpha = 2\sum_{1}^{\infty}\left\{J_0(m).\cos(m\sin\alpha) - J_1(m)\sin\alpha\sin(m\sin\alpha)\right\} \text{ where } m \text{ is odd only} \ldots \quad \ldots\ \ldots \qquad (5)$$

Because the series on the R.H.S. of (5) is uniformly convergent, it can be integrated term by term with respect to $\sin\alpha$.

$$\text{Now } \int_{0}^{\sin\alpha}\cos\alpha\,d(\sin\alpha) = \frac{\alpha + \sin\alpha\cos\alpha}{2}$$

$$\int_{0}^{\sin\alpha}\cos(m\sin\alpha)\,d(\sin\alpha) = \frac{\sin(m\sin\alpha)}{m} \text{ and}$$

$$\int_{0}^{\sin\alpha}\sin\alpha\,.\sin(m\sin\alpha)\,d(\sin\alpha) = -\frac{\sin\alpha\cos(m\sin\alpha)}{m} + \frac{\sin(m\sin\alpha)}{m^2}$$

$$\therefore\ \alpha + \sin\alpha\cos\alpha = 4\sum_{1}^{\infty}\left[\frac{\sin(m\sin\alpha)}{m}\left\{J_0(m) - \frac{J_1(m)}{m}\right\} + \frac{\cos(m\sin\alpha)}{m}\sin\alpha\,J_1(m)\right] \text{ where } m \text{ is odd only.}$$

$$\text{But } J_0(m) - \frac{J_1(m)}{m} = \tfrac{1}{2}\{J_0(m) - J_2(m)\}.$$

Hence $\alpha + \sin\alpha\cos\alpha$

$$= 2\sum_{1}^{\infty}\left[\frac{\sin(m\sin\alpha)}{m}\left\{J_0(m) - J_2(m)\right\} + 2\,\frac{\cos(m\sin\alpha)}{m}\sin\alpha\,.\,J_1(m)\right]$$

where m odd only $\ldots\ \ldots\ \ldots\ \ldots$ (6)

If $\left(\frac{\pi}{2} - \alpha\right)$ is substituted for α the required identity is obtained.

REFERENCES

[1] Thomas, "Theory and Design of Valve Oscillators," 1939 (Chapman and Hall) gives a good account of many of them.

[2] Appleton and Greaves, *Phil. Mag.*, Vol. 45, p. 401 (1923).

[3] Moullin, *J. Instn Elect. Engrs*, Vol. 73, p. 186 (1933).

[4] Groszkowski, *Proc. Inst. Radio Engrs*, Vol. 21, p. 958 (1933).

[5] van der Pol, *Proc. Inst. Radio Engrs*, Vol. 22, p. 1051 (1934); includes a very full bibliography.

[6] Lynch and Tillman, *Electronic Engng*, Vol. 17, p. 382 and p. 414 (1945).

[7] Brunetti and Greenough, *Proc. Inst. Radio Engrs*, Vol. 30, p. 543 (1942).

[8] Terman, Buss, Hewlett and Cahill, *Proc. Inst. Radio Engrs*, Vol. 27, p. 649 (1939).

[9] Tillman, *Wireless Engr*, Vol. 22, p. 17 (1945).

[10] Nyquist, *Bell Syst. tech. J.*, Vol. 11, p. 126 (1932).

[11] Cooper, *Wireless Engr*, Vol. 21, p. 323 (1944).

[12] See, for instance, Freeman, *Proc. Inst. Radio Engrs*, Vol. 26, p. 1360 (1938).

[13] Lynch, Brit. Prov. Pat. No. 13189/45.

[14] Brit. Pat. No. 369,575.

[15] Ladner and Stoner, "Short Wave Wireless Communication," 4th Edition 1942 (Chapman and Hall).

[16] Meacham, *Proc. Inst. Radio Engrs*, Vol. 26, p. 1278 (1938).

[17] Clifford, *Electronic Engng*, Vol. 17, p. 560 (1945).

D

NEW BOOKS

Wireless Direction Finding

By R. KEEN. Pp. 1059+xii, with 633 illustrations. Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. Price 45s.

This is the fourth edition of a book which first appeared soon after the First World War. It is no coincidence that the present revised volume is published after a war in which radio has played such a large part. The achievements of radar systems spring to mind ; but steady advances have also been made in other location methods not involving the reflection of radio waves from a "target." These advances are perhaps not so spectacular—the refinement of a technique, for example, rather than the development of a brand-new one ; a better understanding of the properties of older equipment, or of the medium between transmitter and receiver. It is with the principles, history and current practice of conventional direction finding that the book is mainly concerned. Although, in addition, hyperbolic-navigation systems are considered, and other chapters deal with landing aids for aircraft and beacons, the specialized techniques of radar, as such, and centimetre-wave utilization are deliberately excluded from detailed study.

The author has set out to write "a manual rather than a complete textbook but with a comprehensive bibliography . . . to be of value to students, radio operators and d.f. maintenance and construction personnel as well as to the non-specialist reader." His object has been very largely reached in this essentially practical book, in which the amount of theory is reduced to a bare minimum and in which explanation by word and diagram effectively replaces analysis by symbol.

An introductory chapter, in which the history of direction finding is reviewed in general terms and an estimate made of its likely future application, is followed by a treatment of the propagation of electromagnetic waves ; particular attention is paid to the effects of the ionosphere. Succeeding chapters deal with the principles of direction finding and the directive properties of aerials ; the Bellini-Tosi system is considered in detail. The polarization errors experienced with loop direction finders lead to a consideration of the advantages of Adcock aerial systems. Chapters which follow deal with practical direction finding at permanent land stations on frequencies up to 300 Mc/s ; typical commercial equipments—including spaced loop apparatus—are described, and the problems encountered in their installation and application are discussed. A particularly interesting chapter is concerned with the organization of a direction-finding network and the statistical treatment of bearing data. Separate chapters deal with the awkward difficulties which arise when direction finders are mounted on board ship and on aircraft. It is unfortunate that the important chapter concerned with approach and landing aids for aircraft is divorced from that dealing with beacons ; for the latter is largely concerned with the navigation of aircraft and is naturally complementary to a consideration of the landing problem. Modern equipments incorporating various forms of cathode-ray tube display are given a prominent place in the chapter dealing with special methods of bearing presentation. Another chapter is devoted to a description of radio navigation systems such as Gee, Loran, Decca and Consol ; the properties of these are contrasted with the older systems already described. What appears to be a mis-statement is made at the bottom of page 943 concerning the phasing of the aerial currents to form the "Central Elektra Pattern" ; the distribution described is not consistent with the formation of a course at right angles to the aerial base-line.

The preparation of special charts and maps is considered at various points in the text ; improved continuity would probably have resulted if this information had been collected together and combined with the material of the final chapter dealing with field and nautical astronomy. For similar reasons it would have been preferable to relegate the somewhat extraneous matter, such as the Q code and certain air-traffic and communication regulations, to an appendix.

Attention must be drawn to deficiencies in an early chapter dealing with transmission lines. For example, the reader is confused by typesetting faults on page 96 in the expressions for the line constants ; by a persistent error on page 98 in the sign of the distance-dependent phase terms for the component waves on an open-circuited line ; and by an error in Fig. 73 on page 100. In this figure certain current, voltage and impedance graphs are shown as a function of the distance from the generator end of an open-circuited line ; yet the impedance curve evidently relates to distances measured from the open end of the line.

Despite the drawbacks indicated, the book is to be recommended ; the approach is comprehensive and practical. The well-arranged encyclopædic bibliography, to which very frequent references are made in the text, is particularly commendable.

H. G. H.

Radar System Engineering

Edited by L. N. RIDENOUR. Pp. 748 + xviii, wth 446 illustrations. McGraw-Hill Publishing Co. Ltd., Aldwych House, London, W.C.2. Price 37s. 6d.

American radar research and development during the war was centralized in the Radiation Laboratory, Massachusetts Institute of Technology. Instead of dispersing when their work ended with the war, the staff best qualified to write up the results in a form suitable for publication stayed on for another six months in order to do so. This book is No. 1 in a set of twenty-eight comprising the product of their labours. Its editor is also editor-in-chief of the series, and contributes the whole or part of several chapters. Most of the other books deal with specialized theory and techniques involved in radar but not necessarily confined to it ; for example, magnetrons, waveguides, propagation of short waves, servo-mechanisms, etc. It was wisely planned that these subjects should be treated quite generally, because it was realized that radar might not even be the most important of their applications. As the preface to "Radar System Engineering" says, "this book specializes to radar the techniques reported more fully elsewhere in this series ;" and "it is intended to serve as a general treatise and reference book on the design of radar systems."

The seventeen chapters deal with the theory, operation and design of the various elements, separately and in combination, that make up radar systems, not forgetting the target. Three of the chapter subjects—C. W. Radar Systems, Moving-Target Indication, and Radar Relay—have so far had little place in the literature.

As one would expect from such a source, there is in this book an abundance of authoritative information. It is perhaps only to be expected, too, that its outlook is backward rather than forward. The equipment discussed most fully belongs to a war that is over, while radar for present and future sea and air navigation is barely mentioned. Interesting though they are, the historical and tactical aspects of radar ought not to have been given so much space in what claims to be an engineering treatise. For example, while there is particular detail about the organization and routine procedure of U.S. and British tactical air Commands at various stages of the war, including even tabulated data of tracks reported by a particular Command, there are no appendices or collected tables of data useful in design.

Circuit technique is especially weak, only a portion of one chapter being devoted to it, in spite of the fact that the subject does not appear to be included in the titles of any of the more specialized volumes. The nearest approach to the design of time-base generators is a very superficial description of sawtooth generators extending to less than four pages. The influences of valve capacitances and other second-order effects in pulse-generating circuits are ignored, and the old fallacy that the trailing edge of the pulse from a differentiating circuit is due to the *discharge* of the capacitor crops up once more. Fig. 13.18c, purporting to show the waveform of damped oscillations excited in the anode circuit of a triode, takes no account of the practically important extra damping during the conducting phase of the valve. Seeing that all this has been done so much better and more thoroughly by the Radar School staff of the M.I.T., the space would have been more appropriately devoted to applying the principles to practical quantitative design.

The reviewer was perhaps unlucky in his resort to the index, for he failed to find any reference therein to marine (or sea, or ship) radar, cheese aerials, bootstrap circuit, differentiating circuit, C.H.L., G.C.I., Rebecca, or Eureka, although they were all in the text, and might reasonably have been expected to be signposted in what claims to be a work of reference.

In brief, " Radar System Engineering " is a good book that could have been organized into a much better one. M. G. S.

Radio Aids to Navigation

By R. A. Smith, M.A., Ph.D., A.M.I.E.E. Pp. 114 + xi with 37 illustrations. Cambridge University Press, Bentley House, 200, Euston Rd., London, N.W.1. Price 9s.

The author was concerned with the development of radar methods of navigation during the war and the material in this book was originally prepared as a contribution to the Ministry of Supply (Air) Scientific War Records. Starting with pre-war systems of navigating aircraft, it goes on to describe the war-time systems. It covers d.f. methods, beacons and track guides, as well as radar and C.W. systems, including Gee, Loran, S. S. Loran, Sonne, P.O.P.I., Decca. Centimetre-wave systems, such as H_2S, are included, and there is a chapter on special radar applications covering G.H., Rebecca II, Shoran and Oboe.

Radio altimeters are dealt with and aids to instrument landing, notably S.B.A. and S.C.S.51, of the C.W. types, and B.A.B.S. among the radar methods.

The various systems are briefly described in general terms, sometimes with the aid of block diagrams, and their main characteristics are given. Nothing is said about the circuits adopted, and there is very little detailed information of methods or equipment. Although of a general nature, the book is not one for the non-technical, and it is certainly not a " popular " book.

W. T. C.

F.B.I. Register

The first post-war edition of the F.B.I. Register of Manufacturers is now available and provides the only complete guide to Members of the Federation of British Industries. It includes products and services, address, brands and trade marks sections, and there are reference facilities in French and Spanish. It is available from Kelly's Directories Ltd., 186, Strand, London, W.C.2. Price £2 2s.

Electronic Engineering Master Index

Edited by Frank A. Petralgia. Pp. 202 + x. Electronics Research Publishing Co., 2, West 46th St., New York 19, U.S.A. Price $14.50.

This book is a subject index of selections from over 85 periodicals and covers the period July 1945 to December 1946.

Indexes

As is our custom the Index to the Articles and Authors for the current volume is included in this issue.

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, priced 2s. 8d. (including postage). As supplies will be limited our Publishers ask us to stress the need for early application for copies.

SIR EDWARD APPLETON

The 1947 Nobel Prize in Physics has been awarded to Sir Edward Appleton " for his work on atmospherical physics, and especially for his discovery of the Appleton layer." His important experiment to prove the existence of a reflecting layer in the upper atmosphere took place in December 1924.

The frequency of the B.B.C. transmitter at Bournemouth was varied over a small range and the strength of the signal received at Oxford was found to depend on the frequency. Artificial fading was thus produced, and not only proved that the received signal was composed of waves which had travelled by different paths, but enabled the height of the reflecting layer to be calculated.

Since 1939 Sir Edward has been Secretary of the Department of Scientific and Industrial Research.

CORRESPONDENCE

Letters to the Editor on technical subjects are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

Comparison of A.M. and F.M.

SIR,—The comparison of the relative merits of a.m. and f.m. is not helped by Mr. A. A. McKenzie's quotation from a report on the subject in the *General Electric Review*, Vol. 42, 1939. The conclusions arrived at in that report were based on comparative tests in which the receiver was arranged with a switch to bring into circuit either an f.m. detector with noise limiter or an a.m. detector without limiter. In these circumstances, the statement that the signal-plus-noise to noise ratio was 20–25 db better with f.m. might, for all we know, merely mean that the noise limiter was working. Such tests are completely useless for enabling general conclusions to be drawn as to the relative merits of the two systems of modulation, yet it is on this sort of test that many of the claims for the vast superiority of f.m. have been founded.

Those who seek to maintain these claims also generally make their tests under laboratory conditions with the receiver exactly in tune, and do not stress the fact that unless an effective a.f.c. system is incorporated the signal/noise ratio expected of f.m. is not likely to be obtained, say, by the average broadcast listener.

In his tests, Mr. Nicholson evidently made a serious attempt to compare the two systems under equivalent conditions, and his critics cannot fairly do less. Though it may displease some to have the unqualified superiority of f.m. called into question, it appears that both systems must still be considered on their merits for any particular application. Thus although, as Mr. D. A. Bell has pointed out, f.m. has been approved for certain services by the B.B.C. and the G.P.O., practical experience of both systems has led the Home Office to adopt a.m. for the new county police networks, the first of which has recently been put into service.

Bromley, Kent M. G. SCROGGIE.

SIR,—The paper by Nicholson on this thorny subject, published in your July issue, serves the very valuable purpose of drawing attention to some of the many different problems which confront the engineer whose job it is to choose the best type of equipment to give a particular kind of service using the v.h.f. band. It is important to remember that the various factors weigh differently according to the type of service being considered and so it is not possible to come to a general conclusion, such as that given by Mr. D. A. Bell in the last paragraph of his letter in your September issue. In considering the two very diverse examples which he quotes, it should be borne in mind that in the majority of the reported B.B.C. tests, as in the various reported American tests, f.m. was compared with a.m. without noise limiters, while in the case of the use of f.m. by the Post Office for multichannel links one of the most important reasons for this is the great convenience of low-level modulation for multichannel working.

In his remarks on the use of amplitude limiters for impulse-noise suppression on a.m. receivers Mr. Bell is somewhat misleading and I would like to correct the impression he gives on certain points. Taking in turn the three objections he raises to wide-band a.m. plus amplitude limiters :—

(i) Provided the transmitters operating on the same broad channel are on frequencies actually separated by 20 kc/s or more the interference effects using a.m. or f.m. will not be greatly different, as pointed out by Nicholson.

For mobile communication services (perhaps the most important users of the v.h.f. band) this point is not relevant as here receivers are normally run continuously and transmitters are only on when a message is being passed. Obviously in this case, using either a.m. or f.m., no transmitter sharing a channel should be within range of a receiver working with another transmitter or messages from the second transmitter could be received while the first is idle.

Thus for mobile services wide-band a.m. is certainly no more uneconomical in ether space than f.m. using the same bandwidth, while for broadcast and similar services there should be little difference.

(ii) Receivers nowadays almost invariably use diodes for detection and a.v.c. which, for efficient working, operate at levels of at least 10 volts. This is sufficient for the efficient operation of most noise limiters which are inserted between the detector and the first a.f. valve. There is no difficulty whatsoever in maintaining a bandwidth in excess of the half-bandwidth of the i.f. amplifier up to this point.

(iii) While certain noise-limiter circuits have been suggested which are undoubtedly complicated it can hardly be said that they are more complicated than the circuits met in an f.m. receiver. The simple carrier-controlled limiters give very good results. The series-diode circuit given in Fig. 7 of Nicholson's paper is good but the addition of a shunt diode (see for example *Wireless World*, Dec. 1946, p. 398) improves the noise suppression considerably. This carrier-controlled series-shunt circuit gives an excellent all round performance which is hard to improve on. According to my tests Nicholson's limiter (Fig. 8) can be made to yield an appreciable improvement in impulse-noise suppression (some 10 db) for a certain range of carrier levels (determined by the circuit constants used) but at other carrier levels it behaves little differently from the simpler series-shunt circuit. Hence, for a mobile-communication service at any rate, it is doubtful if the extra complication of this circuit is justified.

Concerning the operation of amplitude limiters they do not, as Mr. Bell suggests, suppress only higher-frequency components of the pulse. The carrier-controlled limiters limit the amplitude of a noise pulse to twice the mean carrier voltage, corresponding to a signal with 100 per cent modulation (or at any other chosen percentage as determined by the circuit constants). This does not alter the frequency distribution of the various components of the pulse, it simply reduces their amplitude. As the bandwidth of the circuit at the limiter is considerably greater than the bandwidth of the audio amplifier which follows, the higher-frequency components are removed in the latter with a consequent lengthening and reduction in peak amplitude of the pulse. In the idealized case the peak amplitude of the output noise pulse will be less than the 100 per cent modulation level in the ratio of the audio bandwidth to the i.f. half-bandwidth. The modulation-following limiters work in a similar manner except that the pulse is limited to the instantaneous modulation level and hence, in theory, should give considerably better results.

In an f.m. system impulse noise is not cut exactly at modulation level as Mr. Bell states and a noise output is obtained whether the carrier is being modulated or not. The latter case is always the more disturbing for impulse noise, as aural masking reduces its effects when modulation is present. The earlier treatments of impulse noise in f.m. were rather unsatisfactory but it has been shown by Landon (*Electronics*, Feb. 1941, Vol. 14, No. 2) that when in an ideal receiver the impulse adds to the carrier, at certain phase relationships which occur at random, rapid changes of instantaneous phase take place leading to large changes of instantaneous frequency. This produces a double impulse at the discriminator whose waveform is the differential of the pulse in the i.f. amplifier. The amplitude of this pulse depends on the bandwidth of the discriminator and the circuit immediately following, but assuming this to be at least equal to the i.f. half-bandwidth (to correspond to the a.m. case) the peak amplitude will correspond to that of a signal with 100 per cent modulation. This pulse will be lengthened and reduced in amplitude in its passage through the a.f. amplifier as in the a.m. case. The peak amplitude of the noise in the case of similar ideal f.m. and a.m. plus carrier-controlled limiter receivers should thus be approximately equal, and but for the different wave shape of the f.m. pulse (corresponding to the triangular spectrum) which gives it a somewhat less disturbing audible effect, the results would be similar.

In a practical f.m. receiver the alignment may not be perfect and the incoming carrier may not lie exactly in the centre of the receiver pass-band. This will cause an additional kind of impulse noise; viz., the "pop" noise discussed by Smith and Bradley (*Proc. Inst. Radio Engrs*, Nov. 1946, Vol. 34, No. 10). This noise does not have the triangular spectrum and sounds much louder than that occurring when the receiver is on tune, and so in this condition a f.m. receiver can be worse in respect of impulse noise than an a.m. receiver with carrier-controlled limiter.

Tests which I have carried out on equipment designed for a mobile communication service confirm these expectations. They show that when a f.m. receiver is on tune there is little to choose between it and a similar a.m. receiver with a series-shunt limiter. In the case of the receiver tested (carrier about 100 Mc/s, i.f. bandwidth 35 kc/s, audio bandwidth 3.5 kc/s) a detuning of the carrier frequency by as little as 1 kc/s produced a marked deterioration of impulse noise performance. This is also the amount of the normal production tolerance on the crystals used for frequency control of such receivers. In practice, therefore, it is not an easy matter to maintain an impulse noise performance on a f.m. receiver which is as good as that given by an a.m. receiver with limiter.

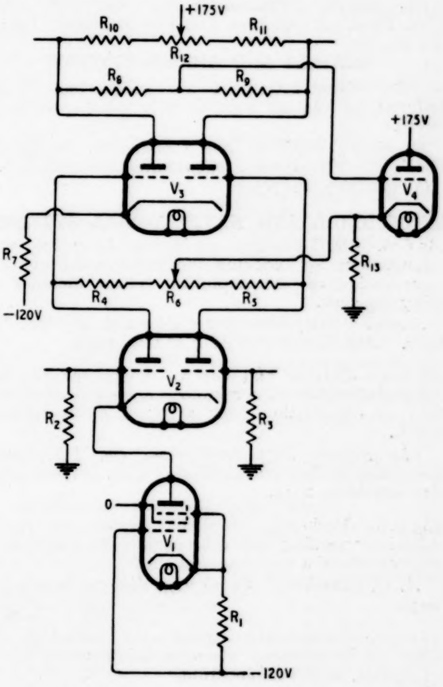
I have not done any work on broadcast-quality f.m. receivers but it is of interest to note that in carrying out the aforementioned tests, I was unable to find any laboratory signal generator which would hold its frequency sufficiently accurately to give minimum impulse noise for more than a few minutes at a time. While the requirements of a broad-band broadcast receiver are less severe, I cannot think that the task of the designer of a reasonably priced broadcast f.m. receiver will be an enviable one.

I. F. MACDIARMID,

Dollis Hill, N.W.2.

Electro-encephalograph Amplifier

SIR,—By a simple modification to the circuit (Fig. 10) of the amplifier described by D. L. Johnston in your August issue, it is possible to increase the gain of the two stages by a factor of two. Use is made in the modified circuit shown below of a cathode follower to provide high tension for the first stage, the cathode follower being controlled by the mean potential of the anodes of the second stage. This method of applying feed-back from one stage to the preceding stage can be of considerable value in the design of direct-current amplifiers. An amplifier is being made on these lines.



$R_1 = 2.2\ k\Omega$; $R_2, R_3 = 3.3\ M\Omega$; $R_4, R_5 = 100\ k\Omega$; $R_6 = 10\ k\Omega$; $R_7 = 50 k\Omega$; $R_8, R_9 = 1.2\ M\Omega$; $R_{10}, R_{11} = 100\ k\Omega$; $R_{12} = 10\ k\Omega$; $R_{13} = 33\ k\Omega$; $V_1 = 6AG5$; $V_2, V_3 = 6J6$; $V_4 = 6SN7$ (*one half*).

E. J. HARRIS.
P. O. BISHOP.

University College, London.

WIRELESS PATENTS

A Summary of Recently Accepted Specifications

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

ACOUSTICS AND AUDIO-FREQUENCY CIRCUITS AND APPARATUS

585 667.—Low-frequency power-amplifier with provision for maintaining a stabilized feed-back as the load varies.

Patel Hold Patentverwertungs &c. A.G. Convention date (Switzerland) 17th July, 1942.

586 102.—Method of clamping the needle of a gramophone pickup so that it is held firmly, relatively to the magnet-poles, whilst being free to follow the grooves in the record.

The British Thomson-Houston Co. Ltd. and G. H. Dyer. Application date 13th December, 1944.

AERIALS AND AERIAL SYSTEMS

586 085.—Construction of a shielded loop-aerial designed to radiate substantially plane-polarized waves.

Standard Telephones and Cables Ltd. (assignees of W. D. McGuignan). Convention date (U.S.A.) 15th November, 1943.

DIRECTIONAL AND NAVIGATIONAL SYSTEMS

585 826.—Radiolocation equipment in which the arrangement for blocking the receiver during the transmission of the exploring pulses includes a delay network.

Standard Telephones and Cables Ltd. and M. M. Levy. Application date 11th March, 1941.

585 871.—Driving and control means for causing the aerial system of a radiolocation set to scan the field of observation over a sector of adjustable width.

The British Thomson-Houston Co. Ltd. (communicated by the General Electric Co.). Application date 9th May, 1944.

585 906.—Push-pull amplifier circuit for intermittently feeding the echo-signals to the goniometer coils of a radiolocation set.

A. D. Blumlein. Application date 3rd November, 1939.

585 907.—Integrating circuit for reducing the effect of interference when receiving pulsed trains of signals, as in radiolocation.

A. D. Blumlein and E. L. C. White. Application date 1st December, 1939.

585 909.—Radiolocation equipment in which the scanning controls of the c.r. indicator are arranged to facilitate the identification of a selected echo-signal in the presence of others.

E. L. C. White. Application date 29th January, 1940.

585 986.—Radiolocation set utilizing horn-shaped receiving aerials, arranged symmetrically about the transmitter, and feeding the echo-signals to a common c.r. indicator.

D. I. Lawson, D. Weighton, and Pye Ltd. Application date 6th February, 1940.

586 033.—Construction of V-shaped d.f. aerial, with reflecting element, particularly for a portable blind-landing equipment.

Standard Telephones and Cables Ltd. (assignees of L. Himmel and M. Fuchs). Convention date (U.S.A.) 12th June, 1943.

586 116.—Phase-correcting arrangement for securing a high signal-to-noise ratio in a radiolocation set when the exploring pulses are of random phase and timing.

Standard Telephones and Cables Ltd. and C. W. Earp. Application date 11th March, 1941.

586 119.—Radiolocation system in which the frequency of the exploring pulse is automatically controlled by the echo signal until the distance of the target is indicated by a specific phase-difference.

Standard Telephones and Cables Ltd., P. K. Chatterjea, and L. W. Houghton. Application date 15th October, 1941.

TELEVISION CIRCUITS AND APPARATUS

For Transmission and Reception

585 458.—Cathode-ray tube in which the usual fluorescent screen is replaced by one coated with an alkali halide on which the scanning-stream produces a transient discolouration.

P. G. R. King, P. W. Wells, and C. S. Wright. Application date 26th October, 1942.

586 034.—System in which one set of signals is transmitted during the periodic intervals between a different set of signals, applicable to television-and-sound systems.

Marconi's W. T. Co. Ltd. (assignees of G. L. Fredendall and A. C. Schroeder). Convention date (U.S.A.) 29th May, 1943.

TRANSMITTING CIRCUITS AND APPARATUS

See also under Television

585 471.—Probe-device, free from capacitance-variations, for measuring the energy flowing through a waveguide or concentric transmission-line.

G. E. F. Fertel, R. W. L. Batt, and C. S. Wright. Application date 7th June, 1944.

585 482.—Power amplifier designed to prevent excessive power-dissipation under off-tune conditions, particularly in portable transmitting sets.

A. C. Cossor Ltd. and A. H. A. Wynn. Application date 28th September, 1944.

585 672.—Two-valve oscillatory circuit of the so-called " butterfly " type designed to ensure optimum stability when generating centimetre waves.

The British Thomson-Houston Co. Ltd. and R. G. Hibberd. Application date 19th December, 1944.

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Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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534.2–14 **1**

Transmission, Reflection, and Guiding of an Exponential Pulse by a Steel Plate in Water : Part 2 — Experiment.—M. F. M. Osborne & S. D. Hart. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 170–184.) Part 1 (Theory) was abstracted in 3560 of 1945, with brief reference to the present experimental work.

534.22–13 **2**

The Velocity of Sound : a Molecular Property.—E. G. Richardson. (*Nature, Lond.*, 31st Aug. 1946, Vol. 158, No. 4009, pp. 296–298.)

534.26 **3**

The Diffraction of Sound Pulses : Part 1 — Diffraction by a Semi-Infinite Plane ; Part 2 — Diffraction by an Infinite Wedge ; Part 3 — Note on an Integral occurring in the Theory of Diffraction by a Semi-Infinite Screen ; Part 4 — On a Paradox in the Theory of Reflexion.—F. G. Friedlander. (*Proc. roy. Soc. A.*, 24th Sept. 1946, Vol. 186, No. 1006, pp. 322–344, 344–351, 352–356 & 356–367.)

534.321.9 : 621.396.9 **4**

Radar in Nature.—T. Roddam. (*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 286–288.) The nature of the mechanism by which a bat produces supersonic pulses was described in 258 of 1946 (Hartridge). Its performance is here considered, with a theoretical discussion of the requirements of a radar model using supersonic waves in air.

534.84 **5**

Improvement in the Acoustics of Reinforced Concrete Buildings by the Oelsner Method.—(*Tech. wet. Tijdschr.*, Jan./March 1945, Vol. 14, Nos. 1/3, p. 14. In Flemish.) Summary of a paper in *Ingeniør-og-Bygningsvoesen*, 10th Feb. 1943.

621.317.75.029.3 : 532.593 **6**

A Frequency Analyser used in the Study of Ocean Waves.—Barber, Ursell, Darbyshire & Tucker. (*See* 203.)

621.395.61 : 534.43 **7**

Tuned-Ribbon Pickup.—W. F. Leidel, Jr., & N. E. Payne. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 67–69 . . 101.) Describes a variable-reluctance type of gramophone pickup in which the armature is supported by a tensioned ribbon. Extremely low mass and a flat response up to 10 000 c/s are claimed.

621.396.615.11 **8**

A Simple "Wien Bridge" Audio Oscillator.—H. T. Sterling. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 29–32.) Details of the theory of operation show that the oscillator has a good waveform and a uniform output amplitude with respect to frequency. Practical circuits are given for (*a*) an oscillator having a variable range from 15 c/s to 150 kc/s, and (*b*) an oscillator having ten spot frequencies between 20 c/s and 20 kc/s.

621.395.625.6 **9**

16-mm Sound-on-Film Recorders.—J. Neil. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 309–312.)

AERIALS AND TRANSMISSION LINES

621.315.2 : 621.317.33.029.63 **10**

The Measurement of Cable Characteristics at Ultra-High Frequencies.—Jones & Sear. (*See* 175.)

621.315.21.029.4/.6] : 621.317.33 **11**

Characteristics of R.F. Cables.—Stamford & Quarmby. (*See* 174.)

621.315 [.211.2 + .22 **12**

Mineral-Insulated Metal-Sheathed Conductors.—F. W. Tomlinson & H. M. Wright. (*J. Instn elect. Engrs*, Part II, Aug. 1946, Vol. 93, No. 34, pp. 325–335. Discussion, pp. 336–340.) Powdered magnesium oxide is a very satisfactory insulating material. Its dielectric constant is 3.6 and power factor 0.000 5. Copper-covered cable with this insulator is suitable for transmission at frequencies up to several hundred megacycles per second. Properties, applications, and methods of manufacture and installation of such cables are discussed.

621.315.232.014.1 **13**

[Current] **Rating of Cables in Ducts.**—C. C. Barnes. (*Elect. Times*, 31st Oct. 1946, Vol. 110, No. 2871, pp. 583–586.) Tables and graphs are given for calculating the rating, which is lower owing to heat effects than for other forms of installation.

621.317.336 **14**

Impedance Matching with an Antenna Tuner.—G. G. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 38–40.)

621.392 **15**

On the Eigen-Values of an Electromagnetic Waveguide.—T. Kahan. (*C. R. Acad. Sci., Paris*, 11th Feb. 1946, Vol. 222, No. 7, pp. 380–381.) The behaviour of a straight waveguide of rectangular cross-section is illustrated by means of the special case of a square cross-section. The form of the vector potential and nodal surfaces (which divide the guide into electrically distinct portions) is considered for some of the simpler possible modes.

621.392.2 **16**

On the Propagation of Waves in Curved Guides.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 4th March 1946, Vol. 222, No. 10, pp. 537–538.) The method of perturbation can be used to determine the deformation of E_0 or H_0 waves in cylindrical guides even when the conductivity σ of the walls is finite. The perturbation terms remain small provided that the curvature C does not exceed a value independent of σ for E_0 waves and a much smaller value, decreasing to zero as σ increases indefinitely, for H_0 waves. The E_0 waves are stable; the phase velocity and attenuation factor (dependent on σ) are independent of curvature to a second-order approximation. For a perfectly conducting guide the H_0 wave is unstable; for large C and σ a solution still exists but differs radically from the H_0 wave. For rectangular guides, an analogous method yields an approximate formula easier to use than the exact formula obtained by the Bromwich-Borgnis method. If the walls are perfect conductors, the phase velocity is not modified (to a second-order approximation) by the curvature, and both E_0 and H_0 waves are stable.

621.392.43 **17**

Conditions of Termination in a Waveguide.—T. Kahan. (*C. R. Acad. Sci., Paris*, 4th March 1946, Vol. 222, No. 10, pp. 535–537.) A proof that if a waveguide is terminated by a semi-transparent cavity whose length is an odd number of quarter wavelengths, no standing waves are produced whatever the mode of vibration. For a definition of semi-transparent cavity see 1795 of 1946.

621.392.43.082.7 **18**

Note on a Reflection-Coefficient Meter.—N. I. Korman. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 657–658.) The reflection coefficient of a network N terminated by an impedance Z_L is defined as $r = \dfrac{Z_0 - Z_L}{Z_0 + Z_L}$ where Z_0 is an impedance such that the current through an indicating device V is zero. It is deduced that the indication of V will be proportional to r if (1) N is a linear, bilateral, passive network, (2) Z_0 is a physically realizable impedance and (3) the output impedance of N equals Z_0.

621.392.5 **19**

Equalized Delay Lines.—Kallmann. (*See* 41.)

621.396.67 **20**

New B.B.C. Mast.—(*Elect. Rev., Lond.*, 25th Oct. 1946, Vol. 139, No. 3596, p. 643; *Electrician*, 18th Oct. 1946, Vol. 137, No. 3568, p. 1078.) Improved reception of the B.B.C. Home Service programme on 342.1 m was made possible from 29th Sept. 1946, by the use of a new 500-ft vertical radiator (with adjustable capacitance-loading) erected at Brookman's Park.

621.396.67 **21**

Aerials.—W. Buys. (*Tech. wet. Tijdschr.*, Jan./March, April/June & July/Sept. 1945, Vol. 14, Nos. 1/3, 4/6 & 7/9, pp. 6–13, 29–41 & 63–72. In Flemish.) Summarizes theory and practice up to 1941.

621.396.67 **22**

The Calculation of Auxiliary Functions for Straight Receiving Aerials of Any Height.—J. Müller-Strobel & J. Patry. (*Helv. phys. Acta*, 1944, Vol. 17, No. 6, pp. 455–462.) An extension of 3527 of 1945 to aerials of any length compared with the wavelength, but assuming constant field strength along the aerial.

621.396.67.011.2 **23**

Simplifications in the Consideration of Mutual Effects between Half-Wave Dipoles in Collinear and Parallel Orientations.—K. J. Affanasiev. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 635–638.) Simple expressions for the mutual impedance which do not involve the Si and Ci functions are derived. They are in close agreement with the more exact results of Carter (1932 Abstracts, p. 585) for aerial separations greater than one wavelength. For parallel $\lambda/2$ dipoles with spacing D the modulus of the mutual impedance is given as $60\lambda/\pi D\ \Omega$.

621.396.674 **24**

Radiation from Large Circular Loops.—E. B. Moullin. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 345–351.) A calculation of the radiation resistance and polar diagram of loops of any radius at a large distance. The field can, by suitable choice of radius, be made zero in the equatorial plane or at any angle of elevation. " It is shown that the 'high-angle' radiation can be sensibly removed by using two concentric and coplanar loops having suitably chosen radii; but with this disposition the current must be supplied to both loops and it is impracticable to induce one current from the other. The 'high-angle' radiation can also be much reduced by the use of two similar coaxial large loops in parallel planes, and this offers a disposition which may be useful in practice."

621.396.674.011.2 **25**

Special Aspects of Balanced Shielded Loops.—L. L. Libby. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 641–646.) An analysis of the impedance of the screened loop aerial in terms of an equivalent uniform transmission-line section. In a numerical example concerning a circular loop of 1-ft diameter, the theoretical resonant frequency (79.4 Mc/s) is found to be within 5% of the measured value.

621.396.677 : 621.397.5 **26**

Rhombic Antennas for Television.—J. Minter. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 58–61.) Design data for aerials receiving horizontally polarized signals in the ranges 44–215 Mc/s and 480–920 Mc/s with polar diagrams for various lengths of side. A forward inclination of the rhombic is used to lower the main lobe.

621.396.678 **27**

A New Kind of Skyhook.—D. T. Ferrier & W. G. Baird, Jr. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 24–25.) A description of a "kytoon" having the advantages of both a kite and a balloon. The casing is made of light nylon fabric and the bladder of neoprene. The kytoon when deflated can be carried in a package 14 inches long and 3 inches in diameter. It is used for erecting aerials at mobile stations in a short time.

621.396.67 (02) **28**

Currents in Aerials and High Frequency Networks. [Book Review]—F. B. Pidduck. Oxford Univ. Press, 97 pp., 8s. 6d. (*Phil. Mag.*, Oct. 1945, Vol. 36, No. 261, p. 730.) ". . . no one interested in aerial theory can afford to neglect this hitherto unpublished account." See also 1182 of 1946.

CIRCUITS AND CIRCUIT ELEMENTS

621.3 : 519.241.6 **29**

An Extension of Campbell's Theorem of Random Fluctuations.—R. S. Rivlin. (*Phil. Mag.*, Oct. 1945, Vol. 36, No. 261, pp. 688–693.) Campbell's theorem giving the mean square deviation of the response $\overline{(y - y)^2}$ of a linear system to a large number of identical random events is extended to the case in which the events are dissimilar, and the quantity $\overline{(y - \bar{y})^p}$ is also calculated. In an addendum the result obtained by Rice for $p = 3$ in the case of identical events is shown to agree with that of the present paper.

621.3.015.1 :621.396.012.8 **30**

Differentiation of a Voltage.—J. Görner. (*Arch. tech. Messen*, July 1940, No. 109, pp. T77–78.) Consideration of RCL, RC, transformer and choke circuits and electromechanical methods.

621.316.313.025 **31**

A.C. Network Analyzer.—N. H. Meyers & N. R. Schultz. (*Gen. elect. Rev.*, Sept. 1946, Vol. 49, No. 9, pp. 34–40.) A general description of the analyser is given. It may be used for determining physical entities from equivalent circuits in problems of the following types: (*a*) short circuits, (*b*) transient stability, (*c*) steady state stability, (*d*) shunting and out-of-step operation of electrical machinery, (*e*) torsional oscillations, (*f*) electromagnetic cavity resonators and (*g*) Schrödinger equation of atom structure.

Once a particular equivalent circuit has been determined, it can be set up on the analyser; readings of current, voltage and power then correspond to certain physical entities in the physical system for which the equivalent circuit has been obtained.

621.316.86 : 546.281.26 **32**

Silicon Carbide Non-Ohmic Resistors.—Ashworth, Needham & Sillars. (*See* 141.)

621.316.974 : 621.318.4.017.31 **33**

Power Loss in Electromagnetic Screens.—C. F. Davidson, R. C. Looser & J. C. Simmonds. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 315–316.) Discussion of the formula derived by C. A. Siocos (2716 of 1946) for the eddy current density in a plane sheet due to an inductor of finite length. It agrees with the formula derived by the writers (see 1077 of 1946) and is more convenient when the inductor is a solenoid.

621.317.336 **34**

Impedance Matching with an Antenna Tuner.—G. G. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 38–40.)

621.318.323.2.042.15 **35**

Permeability of Iron-Dust Cores.—G. W. O. H.: H. W. Lamson: R. E. Burgess. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 291–292 & 313–315.) An editorial discussion of various permeability formulae proposed by Doebke and Howe, and the letters from H. W. Lamson and R. E. Burgess which inspired it. Lamson investigates theoretically the permeability for three arrangements of particles: (i) uniform distribution of aligned cubes, (ii) random distribution of aligned cubes, and (iii) uniformly distributed spheres. The results are tabulated and compared with the experimental values of Legg & Given (4424 of 1940) which are much higher at large iron concentrations. Reasons for this discrepancy are discussed.

Burgess comments on Howe's formula (1933 Abstracts, p. 173) at small iron concentrations, suggests reasons for the discrepancy between this theory and measurement, and draws attention to L. Page's work (1176 of 1942) which provides satisfactory agreement for large iron concentrations.

621.385 : 621.3.011.2 **36**

Negative Resistance Circuit Element.—G. A. Hay. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 299–305.) The possibility of making the dynatron available for dynamic resistance measurement up to 100 Mc/s is considered. After a review of previous work the optimum operating conditions and the equivalent circuit of the dynatron are considered. Measurements of the low-frequency value of the negative resistance (R°_a) by a bridge method and of the high-frequency value (R_a) by a tuned circuit method are described. The ratio $\epsilon = R^{\circ}_a/R_a$ is investigated up to 100 Mc/s after removing a spurious effect due to resonances in the voltage supply leads. It is concluded that ϵ lies between 0.95 and 1.05 up to 50 Mc/s. At higher frequencies the effects of dielectric loss, transit time and valve lead inductances limit the usefulness of the dynatron.

621.385.831.012.8 **37**

Equivalent Noise Representation of Multi-Grid Amplifier Tubes.—R. Q. Twiss & E. J. Schremp.

(*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 696.) North's results for noise generated by multi-grid amplifier valves are extended to the case where there are arbitrary impedances in all the electrode leads. Equations for a pentode are given. Summary of Amer. Phys. Soc. paper.

621.392 **38**

Unification of Linear Network Theory.—J. D. Weston. (*J. Brit. Instn Radio Engrs*, Jan./Feb. 1946, Vol. 6, No. 1, pp. 4–14.) "The concern of this paper is not so much to present new concepts as to achieve a unification of old ones in a consistent scheme." The axioms of projective geometry fall into pairs, so that either member of a pair can be converted into the other by interchanging certain words (correlatives). Associated, therefore, with each theorem derived from the axioms is a valid correlated theorem which may be written down from inspection of the first. There is similar duality in the six axioms (restatements of the laws of Kirchhoff, Ohm, Coulomb and Neumann) applicable to linear, invariant networks having lumped circuit parameters and in which the currents and potentials are steady or slowly varying. "In virtue of this [dual] correspondence it is possible to halve the number of axioms required, provided we add to them the Principle of Duality."

The correlative terms are listed (*e.g.* junction and mesh; admittance and impedance; current and fall of potential) and it is shown how they may be used to group the network theorems into pairs. An outline of the application of the above principles to field theory is given, in which $\mathbf{H}$ and $j\mathbf{E} : \mathbf{M}$ and $j\mathbf{P}$ are the pairs of correlatives. "It is important to notice . . . that the same general principles apply to any dynamical system, the axioms of which can be formulated in an analogous way."

621.392.001.1 **39**

Node-Pair Method of Circuit Analysis.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 661–662.) It is claimed that the confusion and duplication of the impedance and admittance treatments of circuit analysis could be avoided by greater use of the node-pair method, particularly for valve systems. "The node-pair quantities are the most natural and consistent with those already used in everyday measurements."

621.392.5 **40**

Note on a Parallel-T Resistance-Capacitance Network.—A. Wolf. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, p. 659.) Formulae are developed for the performance of a four-terminal parallel-T resistance-capacitance network which serves for the elimination of a given frequency. It is shown that an unsymmetrical form of the network is advantageous when a high degree of frequency discrimination is desired.

621.392.5 **41**

Equalized Delay Lines.—H. E. Kallmann. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 646–657.) The decrease in delay time due to decrease in effective inductance of the coil when the wavelength along the line becomes comparable with the length of the line may be compensated by an increase in the capacitance. This capacitance may be artificially increased by copper strips on the outside of the central coiled conductor, insulated from it, from each other and from earth. Automatic compensation due to the self-capacitance of the coil may suffice with high impedance lines.

The technique of measurement of delay and transmission characteristics is discussed and it is concluded that most of the transmission losses at the higher frequencies occur in the insulation of wire forming the coil. The measurement of input impedance and the matching of the line to source and load are also discussed.

Practical delay lines are described including some with sectional windings. There is a short discussion of the delay in low-pass filters with lumped parameters.

621.392.5 **42**

Network Synthesis, especially the Synthesis of Resistanceless Four-Terminal Networks.—B. D. H. Tellegen. (*Philips Res. Rep.*, April 1946, Vol. 1, No. 3, pp. 169–184.) For a two-terminal network, the "order" is defined as the order of the differential equation of the free vibrations when its terminals are connected by a resistance. This concept is extended to four-terminal networks, and possible types of resistanceless network for various orders are discussed.

621.392.5 **43**

Determination of a Class of Coupled Circuits with n Degrees of Freedom, having the Same Natural Frequencies as a Given Assemblage of n Coupled Circuits, and such that Each Mesh also has the Same Total and Coupling Self-Inductance as the Corresponding Mesh of the Given Assemblage.—M. Parodi. (*C. R. Acad. Sci., Paris*, 11th Feb. 1946, Vol. 222, No. 7, pp. 379–380.) A continuation of 2501 of 1946. The self-inductance condition is satisfied by requiring one of the matrices involved in the earlier theory to be of a special type.

621.392.5 : 621.316.722.078.3 **44**

The Theory of the Non-Linear Bridge Circuit.—G. N. Patchett. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, p. 343.) Discussion of 867 of 1946.

621.392.5 : 621.316.722.078.3 : 621.326[.1 + .3/.4 **45**

The Characteristics of Lamps as applied to the Non-Linear Bridge, used as the Indicator in Voltage Stabilizers.—G. N. Patchett. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 305–322.) The effect of ambient temperature and vibration on the usefulness of various types of lamp in d.c. bridges is considered. "Experimental and mathematical results are given for the response time of various lamps when used in this circuit. Methods of overcoming this delay by means of suitably designed capacitance-resistance networks are given, together with experimental results." See also 867 of 1946.

621.392.52 **46**

The Universal Characteristics of Triple-Resonant-Circuit Band-Pass Filters.—K. R. Spangenberg. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 629–634.) "The universal insertion-loss versus frequency characteristics of a band-pass filter composed of one, two, or three lossless resonant circuits in a loosely coupled cascade connection between a source and a load impedance are given. The effects of load and source coupling and of intermesh coupling upon pass-band insertion-loss variations and upon band width are discussed."

621.392.52 **47**

Double-Derived Terminations.—R. O. Rowlands. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 292–295.) Extension of an earlier method (872 of 1946) of terminating complementary filters at their common ends so that the real part of the image impedance is that of a double-derived section. The technique now described permits a wider choice of attenuation function for a prescribed impedance function.

621.392.52.015.3 **48**

Transient Response of Filters.—C. C. Eaglesfield. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 306–307.) Analysis of the response of a 6-element symmetrical filter section to a sudden application of cos $\omega_0 t$, on the assumption that the pass-band-width is small compared with the central frequency. Equation (7) for the envelope of the output voltage has the same form as Tucker's empirical equation (see 1188 of 1946) but there is a discrepancy between the numerical results which is not fully understood.

621.392.52.091 **49**

The Effect of Incidental Dissipation in Filters.—E. A. Guillemin. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 130–135.) A theoretical paper which presents " a method of ascertaining the effect of these losses on propagation factor, reflection factor and interaction factor ". Approximate formulae are developed for the various portions of a low-pass filter characteristic. It is shown how to extend the results to more complicated networks.

621.394/.397].645.34 **50**

A Variation on the Gain Formula for Feedback Amplifiers for a Certain Driving-Impedance Configuration.—T. W. Winternitz. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 639–641.) An expression is obtained for the gain when the source impedance is the only one across which the feedback voltage is developed. This expression is then used to obtain the response, to a Heaviside unit step, of differentiating and integrating amplifiers and a sweep amplifier driving a cathode-ray tube with magnetic deflexion.

621.394/.396].645.015.33 **51**

Pulse Transmission in Amplifiers.—A. E. Newlon. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 116–121.) An experimental investigation carried out with long pulses at a carrier frequency of 460 kc/s. The results may be ' scaled ' to cover much shorter pulses. The rounding of the leading edge and the increase in length of the pulse are determined for transmission through amplifiers having various steady-state response characteristics ; simple expressions are derived empirically for the pulse distortion in terms of such characteristics. The transmission properties of amplifiers employing single- and double-tuned circuits are compared.

621.396.611 : 518.61 **52**

Calculation of the Electromagnetic Field, Frequency and Circuit Parameters of High-Frequency Resonator Cavities.—H. Motz. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 335–343.) The wave equation $\Delta\phi + (\omega^2/c^2)\phi = 0$ is replaced by a system of difference equations which for free vibrations are soluble only for the ' proper ' values of ω/c. A method for finding the least value of ω/c without solving a determinantal equation is described. The sharp corners of klystron resonator boundaries present a special problem. The analytic behaviour of the fields near such sharp corners is allowed for, in a manner well suited to the relaxation method of solving the equations ; the computation work is thereby reduced. Once the field components and the resonant frequency are found, the beam impedance and the damping constant are easily determined.

621.396.611 : 534.014.2 **53**

An Experimental Investigation of Forced Vibrations in a Mechanical System having a Non-Linear Restoring Force.—C. A. Ludeke. (*J. appl. Phys.*, July 1946, Vol. 17, No. 7, pp. 603–609.) The apparatus is capable of generating and recording forced vibrations ; and the experimental waveforms are compared with the theoretical results given by three graphical methods due to Martienssen (*Phys. Z.*, 1910, Vol. 11, pp. 448–460), den Hartog (*J. Franklin Inst.*, Oct. 1933, Vol. 216, No. 4, pp. 459–473) and Ranscher (*J. appl. Mech.*, 1938, Vol. 5, pp. A169–A177). In all cases, the waveforms of the resulting motion are nearly sinusoidal as long as the frequency of the observed motion is the same as the frequency of the disturbing force, but for a certain kind of non-linearity the frequency of the forced vibration can be made a submultiple (*e.g.* 1/3 or 1/5) of that of the driving force.

621.396.611.3 **54**

Universal Optimum-Response Curves for Arbitrarily Coupled Resonators.—P. I. Richards. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 624–629.) Generalized analysis of the frequency response of a source and sink linked by n coupling elements and n resonators, with the restrictions that (i) all the elements are lossless, (ii) the coupling circuits are not resonant near the central frequency f_0, (iii) all the resonators have their resonant frequencies near f_0, and (iv) the desired bandwidth Δf is small compared with f_0.

The overall loss M has the form $10 \log (1 + Z)$ db where Z is a polynomial of degree $2n$ in x and where $x = (f - f_0)/\Delta f$ and f is any frequency. There is only one optimum form for Z giving maximum off-band rejection with $M \leqslant M_0$ (the allowed loss) in the pass band. This is $Z = d[T_n(2x)]^2$ where $d = [\text{antilog}_{10}(M_0/10) - 1]$, and $T_n(2x)$ is the Tchebycheff polynomial of degree n.

621.396.615.11 **55**

A Simple " Wien Bridge " Audio Oscillator.—Sterling. (*See* 8.)

621.396.615.17 **56**

Multivibrator Circuits.—N. W. Mather. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 136, 138.) Basic types collected for reference, showing waveforms at different points, methods of injecting synchronizing signals, and frequency-determining equations.

621.396.616.029.64 **57**

Buzzer Signal Generator for 3 000 Mc/s.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, p. 140.) A buzzer produces r.f. pulses of complex waveform which pass through a coaxial cable and a coupling loop to a resonator tunable from 1 000 to 3 500 Mc/s. The output is controlled by a piston attenuator.

621.396.645 **58**

Preventing Self-Oscillation in Tetrode Amplifiers.—P. D. Frelich. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 22–23 . . 112.) The grid must be driven from a source of low impedance, *e.g.* a cathode follower. Practical details of a typical circuit are given.

621.396.645 **59**

Transoceanic Radio Amplifier.—C. F. P. Rose. (*Bell Lab. Rec.*, Sept. 1946, Vol. 24, No. 9, pp. 326–329.) A description of the Western Electric D-158974 amplifier, the frequency of which can be rapidly changed between 4.5 and 23 Mc/s and which can operate for 22 hours a day.

The amplifier has one stage employing four 25-kW tubes connected in a push-pull bridge-neutralized circuit with the two tubes on each side of the circuit connected in parallel. The outdoor power plant transforms the three-phase input of 4 160 V to 230 V for the low-voltage equipment and to 13 000 V for the three-phase high-voltage rectifier.

621.396.645.35 **60**

Gas-Tube Coupling for D.C. Amplifiers.—F. Iannone & H. Baller. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 106–107.) "Combining a cathode follower with a gas diode gives a stable and efficient coupling network." The grid of the cathode follower is connected directly to the anode of the driver stage, while the isolating gas tube is in the cathode circuit of the cathode follower.

621.397.645 **61**

Video Amplifier H.F. Response : Part 1.—(*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 301–302.) The procedure for determining the optimum circuit values for the shunt-corrector circuit is given, together with several examples. See part 2 below.

621.397.645 **62**

Video Amplifier H.F. Response : Part 2.—(*Wireless World*, Oct. 1946, Vol. 52, No. 10, pp. 333–334.) The procedure is explained for finding circuit values (*a*) for the flattest frequency response, (*b*) for critical damping, given the drop in response required at a known maximum frequency, or the response required at a known time after the onset of a pulse, and the total circuit capacitance. See part 1 above.

621.392 : 517.432.1 (02) **63**

Heaviside's Electric Circuit Theory. [Book Review]—H. J. Josephs. Methuen, London, 115 pp., 4s. 6d. (*Wireless World*, Oct. 1946, Vol. 52, No. 10, p. 332.) See also 2535 of 1946.

621.396.67 (02) **64**

Currents in Aerials and High Frequency Networks. [Book Review]—Pidduck. (*See* 28.)

GENERAL PHYSICS

530.162 **65**

On Onsager's Principle of Microscopic Reversibility.—H. B. G. Casimir (*Philips Res. Rep.*, April 1946, Vol. 1, No. 3, pp. 185–196.) Onsager's theory of reciprocal relations in irreversible processes is summarized and the fluctuations in the parameters of an adiabatic system are evaluated in a general form. The theory is applied to a number of simple examples : the thermomolecular pressure difference, the conduction of heat in crystals, and the conduction of electricity of solids, considered in terms of an arbitrary four-pole.

535.13 + 621.396.11 **66**

On an Interpretation of the Propagation of E.M. Waves and Its Consequences.—Haubert. (*See* 218.)

535.241.4 **67**

"Foot-Lambert" Unit of Picture Brightness.—(*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 57, 111.) Definition of the term, and its adoption in the television industry.

535.343.4 + 538.569.4.029.64
+ 621.396.11.029.64]:551.57 **68**

The Absorption of 1-cm Electromagnetic Waves by Atmospheric Water Vapor.—Kyhl, Dicke & Beringer. (*See* 219.)

535.343.4 + 621.317.011.5
+ 621.396.11.029.64] : 546.171.1 **69**

The Inversion Spectrum of Ammonia.—W. E. Good. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 213–218.) For a preliminary account see 3236 of 1946.

536 : 621.3.012.8 **70**

Thermal Inductance.—R. C. L. Bosworth. (*Nature, Lond.*, 31st Aug. 1946, Vol. 158, No. 4009, p. 309.) Earlier theory suggested that there are no inductances in the equivalent circuits of a thermal system because of the absence of oscillatory phenomena. Further theoretical and experimental investigation shows that transients in a fluid system with convection currents can only be explained by postulating an inductance corresponding to the kinetic energy of the currents.

537.122 : [537.312.62 + 538.224 **71**

Diamagnetism and Superconductivity of a Collective Electron Assembly.—W. Band. (*Proc. Camb. phil. Soc.*, Oct. 1946, Vol. 42, Part 3, pp. 311–327.)

537.122 : 538.3 **72**

The Classical Equations of Motion of an Electron.—C. J. Eliezer. (*Proc. Camb. phil. Soc.*, Oct. 1946, Vol. 42, Part 3, pp. 278–286.)

537.222.1 **73**

The Two-Dimensional Electric Field of a Single Semi-Infinite Rectangular Conductor.—N. Davy. (*Phil. Mag.*, Oct. 1945, Vol. 36, No. 261, pp. 694–705.) The equipotentials and lines of force inside and outside a charged semi-infinite rectangular conductor are investigated theoretically and experimentally and their distribution shown in diagrams. The electric intensities, surface densities, total charges, capacitances, and mechanical forces on an external object are discussed, and special cases of a semi-infinite thin plate and an infinitely narrow hollow conductor are considered.

537.226 : 62 **74**

Theoretical Physics [of dielectrics] **in Industry.**—Fröhlich. (*See* 124.)

537.291 **75**

Influence of Space Charge on the Bunching of Electron Beams.—L. Brillouin. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 187–196.)

The application of the Llewellyn method of integration to electron motion within plane structures, taking account of space charge effects, is described. The conditions for bunching, *i.e.* intersection of trajectories, are investigated by this method for the cases of (1) a conventional plane diode, (2) a diode with given initial electron velocity (with sinusoidal velocity modulation as a special case), (3) a plane magnetron, (4) a plane magnetron with velocity modulation. In the last case it is shown that multiple intersections occur with strong magnetic fields.

537.5 : 621.385.18.029.64 **76**

Conductivity of Electrons in a Gas at Microwave Frequencies.—H. Margenau. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 698.) "Using the energy distribution law the complex conductivity is calculated as function of electron density, gas pressure and frequency of the field." The results are applied to t.r. switches. See 3818 of 1946. Summary of Amer. Phys. Soc. paper.

537.531 + 539.165 **77**

Calorimetric Experiment on the Radiation Losses of 2-Mev Electrons.—W. W. Buechner & R. J. Van de Graaff. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 174–177.)

538.691 **78**

Apparatus showing the Path of an Electrified Particle in a Magnetic Field.—J. Loeb. (*C.R. Acad. Sci., Paris*, 25th Feb. 1946, Vol. 222, No. 9, pp. 488–490.) If a light flexible wire is placed in any given magnetic field, the ratio of the (direct) current carried to the tension can be chosen so that it assumes the shape of the trajectory of a given charged particle in the same field. For example, a silver wire of diameter 2.10^{-3} cm carrying a current of 500 mA and with a tension of 18 dynes represents a particle charged to 10 000 V. The method can be applied to the study of (*a*) the motion of charged particles in the earth's magnetic field, (*b*) finding pairs of image points for magnetic electron lenses, and (*c*) the movement of ions in apparatus used in nuclear chemistry.

539.16.08 **79**

A Report on the Wilson Cloud Chamber and Its Applications in Physics.—N. N. Das Gupta & S. K. Ghosh. (*Rev. mod. Phys.*, April 1946, Vol. 18, No. 2, pp. 225–290.) A comprehensive account of recent developments in the design and use of the apparatus, with particular reference to its application to the study of cosmic rays. The physics of drop formation is also discussed. There is an extensive bibliography.

546.3 + 669 **80**

Electrons and Metals : Part 2 — The Nature of a Metal.—Hume-Rothery. (*See* 145.)

530.145 (02) **81**

Philosophic Foundations of Quantum Mechanics. [Book Review]—Reichenbach. (*See* 321.)

537 + 538](075.3) **82**

Principles of Physics. Vol. 2 : Electricity and Magnetism. [Book Review]—F. W. Sears. Addison-Wesley Press, Cambridge, Mass., 1946, 434 pp., $5.00. (*Science*, 2nd Aug. 1946, Vol. 104, No. 2692, pp. 112–113.) Written for a two-year elementary course. "A genius for clear explanations runs through . . . the whole series . . . The usual welter of units and viewpoints is brought here into a lucid, teachable orderliness." Vols 1 and 3 were published in 1945.

537.591(042) **83**

Kosmische Strahlung. [Book Review]—W. Heisenberg (Ed.). Springer, Berlin, 1943. (*Schweiz. Arch. angew. Wiss. Tech.*, March 1946, Vol. 12, No. 3, p. 104.) Reprints of lectures given at the Max Planck Institute, Berlin. ". . . in highly concentrated form the best review of the properties of cosmic radiation hitherto published."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA.

523.2 : 621.396.9 **84**

Radar Measurement of Inter-Planetary Distances.—(*See* 105.)

523.2 : 621.396.9 : 621.396.1 **85**

Astronomical Radar.—Clarke. (*See* 106.)

523.72 : 621.396.822.029.62 **86**

Circular Polarization of Solar Radio Noise.—E. V. Appleton & J. S. Hey. (*Nature, Lond.*, 7th Sept. 1946, Vol. 158, No. 4010, p. 339.) Application of the magneto-ionic theory to the radiation of electromagnetic waves from sunspots shows that such radiation (solar noise) should be circularly polarized. This result was experimentally verified for noise from sunspots on a frequency of 85 Mc/s. See also 323 of 1946 (Appleton) and 1825 of 1946 (Hey : Stratton) and 87 and 89 below.

523.72 : 621.396.822.029.62 **87**

Origin of Solar Radiation in the 1–6 Metre Radio Wave-Length Band.—K. O. Kiepenheuer. (*Nature, Lond.*, 7th Sept. 1946, Vol. 158, No. 4010, p. 340.) It is claimed that the oscillation of electrons in circular orbits under the influence of the magnetic field in the neighbourhood of a sunspot is sufficient to explain the increased radiation of solar noise from these regions. See also 86 and 89.

523.72 : 621.396.822.029.62 **88**

Polarization of Solar Radio-Frequency Emissions.—D. F. Martyn. (*Nature, Lond.*, 31st Aug. 1946, Vol. 158, No. 4009, p. 308.) Observations were made at Canberra on 200 Mc/s of the large sunspot group at the end of July 1946. Four Yagi arrays in two perpendicular sets spaced by $\lambda/4$ in the line of sight were used to accept only one sense of circular polarization. The (power) ratio of right-handed polarization to left-handed was about 7 : 1 before the group reached the solar meridian, but became 1 : 5 after the group had crossed it. Magneto-ionic theory shows that in both cases, the "extraordinary" ray is stronger than the "ordinary". See also 1823 of 1946 (Pawsey, Payne-Scott & McCready) and 3252 of 1945 (Southworth).

523.72 : 621.396.822.029.62 **89**

Solar Radiation on 175 Mc/s.—M. Ryle & D. D. Vonberg. (*Nature, Lond.*, 7th Sept. 1946, Vol. 158, No. 4010, pp. 339–340.) By the use of two aerial systems spaced several wavelengths apart, solar radiation on a frequency of 175 Mc/s has been observed even on days of low sunspot activity. The method is analogous to Michelson's interference method of measuring stellar diameters. On the occasion of the passage of a large sunspot, the approximate diameter of the source of radiation was found to correspond with that of the visual spot. The circular polarization of the radiation from the spot was confirmed. See also 86 and 87 above, and 1823 of 1946 (Pawsey, Payne-Scott & McCready).

523.74/.75] : 550.385 **90**

Magnetic Storms and Solar Activity, 1945.—(*Observatory*, Feb. 1946, Vol. 66, No. 830, p. 225.) Statement of sunspot numbers, positions, and sizes, with number and intensity of solar flares. Eleven geomagnetic storms were recorded; there was little tendency for recurrence at 27-day intervals as in the recent sunspot minimum epoch.

523.746 : [550.385 + 621.396 **91**

Sunspots and Radio.—H. Spencer Jones. (*Observatory*, Aug. 1946, Vol. 66, No. 833, pp. 326–327.) Lecture by the Astronomer Royal on the history and characteristics of sunspots, and the consequent radio fade-out, radio noise, and magnetic storms.

523.747 : 550.38 **92**

On the Coincidence of Short Period Magnetic Activity and the Appearance of Faculae on the Sun.—M. Burgaud. (*C. R. Acad. Sci., Paris*, 4th March 1946, Vol. 222, No. 10, pp. 563–564.) It is suggested, as a result of examining past records, that geomagnetic disturbances of gradual commencement are connected with the growth, or rather the birth, of faculae. Tables are given comparing geomagnetic disturbances with the appearance of calcium flocculi for Jan./Feb. 1925, and for 1920–1931.

537.591 **93**

Cosmic Rays and Their Origin.—A. C. B. Lovell. (*Endeavour*, April 1946, Vol. 5, No. 18, pp. 74–79.) " This article gives a brief description of recent work and of previous experiments." The nature of the incident radiation from space is discussed together with the ensuing collision processes.

537.591 **94**

Cosmic Radiation above 40 Miles.—S. E. Golian, E. H. Krause & G. J. Perlow. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 223–224.) Cosmic-ray data at heights of 200 000 to 350 000 ft have been obtained by apparatus contained in a V2 rocket. A number of counters in the warhead were made to transmit results to the ground by multichannel radio equipment. The counters were arranged to provide data on showers and coincidences, one set being shielded by lead. Provisional results are given.

537.591 **95**

On the Production of Penetrating Ionizing Particles by the Non-Ionizing Component of Cosmic Radiation.—P. J. G. de Vos & S. J. du Toit. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 229–230.)

537.591 **96**

The Power Spectrum of the Cosmic-Ray Cascade Component.—E. P. Ney. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 221–222.)

539.16.08 **97**

A Report on the Wilson Cloud Chamber and Its Applications in Physics.—Das Gupta & Ghosh. (*See* 79.)

550.38 **98**

Induction Effects in Terrestrial Magnetism: Part 2—The Secular Variation.—W. M. Elsasser. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 202–212.) For part 1 see 1834 of 1946; see also 958 of 1942.

550.38 **99**

On the Origin of Terrestrial Magnetism.—Y. P. Bulashevich. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1944, Vol. 8, Nos. 2/3, pp. 93–95. In Russian.) According to Haalck's theory the existence of temperature and pressure gradients in the crust of the earth causes a partial movement of electrons from the central part of a metallic nucleus towards its periphery. The rotation of the redistributed charges, owing to the diurnal rotation of the earth, causes the appearance of the magnetic field. A formula is given for the magnetic moment M in which a coefficient β is determined by equating M to an observed value. Haalck's theory is based on erroneous conceptions of the behaviour of electrons in a metal and if β is calculated from theoretical considerations instead of an empirical comparison, the formula for M will give a value 10^{14} times too low.

551.509 **100**

Weather Forecasting.—H. B. Brooks. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 84–87.) A brief account of the methods and equipment used by the U.S. Army for the measurement of wind velocity at high levels in the atmosphere, and of the application of centimetre-wave radar apparatus to storm detection. The importance of these techniques in weather forecasting and in reducing flying risks is indicated.

551.510.535 : 621.396.11 **101**

The Effect of the Ionosphere on Radio Communication.—McNicol. (*See* 219.)

624.13 **102**

Soil Compaction, Moisture, and [load] **Bearing Value.**—A. H. Gawith. (*J. Instn Engrs Aust.*, June 1946, Vol. 18, No. 6, pp. 109–115.)

LOCATION AND AIDS TO NAVIGATION

519.2 **103**

On the Location of a Point on a Plane by Cross Bearings from Three Known Points.—M. I. Yudin. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1944, Vol. 8, Nos. 2/3, pp. 96–102. In Russian.) Experience has shown that in plotting on a chart the position O of a point in a plane by taking bearings from different known points, the most effective results are obtained when these observations are taken from three such points. On account of errors in observations, the straight lines drawn from the three points will not intersect at a single point, but form a small triangle. In the present paper equations are derived for determining the most probable position O′ of the observed point within the area of the triangle, and for calculating the quadratic error of such a determination. This is compared with the quadratic error for the case when two observations only are made. The advantages of using three observation points are discussed and methods are indicated for the most rational selection of the observation points. In conclusion, a graphical method for determining O′ is described.

The method discussed has wide applications in artillery practice and in geodesic surveys. It is also used in radio direction finding and for various other purposes, such as the determination of the wind from three angles of drift of an aeroplane.

For an extension of this paper, see 2959 of 1946.

621.396.9 **104**

The Evolution of Radiolocation.—R. A. Watson-Watt. (*J. Instn elect. Engrs,* Part I, Sept. 1946, Vol. 93, No. 69, pp. 374–382.) A general historical survey of British radar development, delivered at the I.E.E. Radar Convention, March 1946. Fundamental scientific research, the British radio industry, and the needs of the Royal Air Force all vitally affected radar development; the interplay of operational and technical experience and opinion, and close collaboration between scientists and Service users might be called our real secret weapon. A few ‘technical milestones’ briefly described were: monostatic working; first radar responder system; rotating beams; precision range- and direction-finding; airborne and shipborne radar; the plan position indicator; common aerial for transmission and reception; the ‘memory tube’; hyperbolic navigation; development of centimetre technique; terrain discrimination; unorthodox visibility and radar detection of clouds; and location of V2 sites.

In conclusion, tribute is paid to the radio industry's achievements under ‘crash programme’ conditions, and some outstanding land, sea, and air uses of radar as a weapon of war are mentioned.

621.396.9 : 523.2 **105**

Radar Measurement of Inter-Planetary Distances.—(*Observatory,* Feb. 1946, Vol. 66, No. 830, pp. 193–194.) Successful radar detection of the moon suggests the use of radar to measure interplanetary distances more accurately. Milne's kinematic relativity theory assumes in effect that astronomical distances are thus measured.

621.396.9 : 523.2 : 621.396.1 **106**

Astronomical Radar.—A. C. Clarke. (*Wireless World,* Oct. 1946, Vol. 52, No. 10, pp. 321–323.) A description of U.S. Signals Corps work on radar echoes from the moon using a parabolic aerial array, and a discussion of the possibility of obtaining echoes from the nearer planets or the sun by pulse methods using either microwave or optical frequencies. Future applications of lunar reflection for point-to-point radio transmission are suggested.

621.396.9 : 534.321.9 **107**

Radar in Nature.—Roddam. (*See* 4.)

621.396.9 : 621.385.832 **108**

Skiatron.—(*See* 302.)

621.396.93 **109**

Naval Airborne Radar.—L. V. Berkner. (*Proc. Inst. Radio Engrs, W. & E.,* Sept. 1946, Vol. 34, No. 9, pp. 671–706.) “Requirements in the early months of the war were fulfilled by meter-wave radar using lobe-switching techniques. The development of microwave radar gave enormous impetus to airborne applications and produced advanced types for air-to-air interception, high- and low-altitude bombing, reconnaissance, submarine search, and many specialized applications. The sharp beam produced by microwave radiation with relatively small antennas makes microwave techniques particularly adaptable to aircraft use and provides a vastly improved display permitting installation with low aerodynamic drag. Several types of airborne radar are briefly described and illustrated. Fundamental problems of design are reviewed. Related problems such as size, weight, and performance at high altitude are considered and solutions are discussed. Several types of display particularly suited to aircraft use, such as PPI, B, O, and G are illustrated. Utilization, applications, and advantages of auxiliary devices, such as computers, beacons, delay circuits, etc., are discussed. Solutions to systems problems introduced by use of a multiplicity of electronic gear within the aircraft are reviewed. The limitations and advantages of airborne radar as a solution to future aircraft problems are briefly considered.”

621.396.93 **110**

Airborne Search Radar.—J. H. Cook. (*Bell Lab. Rec.,* Sept. 1946, Vol. 24, No. 9, pp. 321–325.) The American ASH or AN/APS-4 airborne radar equipment has a bomb-shaped unit containing the aerial, power circuits, transmitter and receiver. It weighs 150 lb (with associated units) and hangs in a standard bomb-rack under the wing of the aircraft. The wavelength is 3.2 cm, and beam width 6°. The beam is scanned horizontally over 150° once or twice per second. The equipment is used for ground scanning or to determine the relative elevation of another aircraft. Reports of its operational use are included.

621.396.93 **111**

Radar for Carrier-Based Planes.—C. B. Barnes. (*Electronics,* Oct. 1946, Vol. 19, No. 10, pp. 100–105.) Details of the APS-4 light-weight radar equipment operating on about 9 375 Mc/s. The equipment is suitable for search and interception roles while provision is also made for beacon operation. In each application type B display is used (slant range/azimuth on a Cartesian graticule); in interception operation there is special provision for simultaneous indication of the angle of elevation of the target on the display tube.

621.396.933 **112**

Radio Aids to Civil Aviation.—(*Engineering, Lond.,* 13th Sept. 1946, Vol. 162, No. 4209, p. 254.) An editorial dealing with the visit of delegates of the Provisional International Civil Aviation Organization to this country to inspect British equipment already in operation for controlling aircraft, and other experimental apparatus. Methods demonstrated included short-range supervision of flight and control of aircraft outside the approach zone, using very high frequency voice telephony and long-distance communication associated with teleprinters. Demonstrations were also given of radar methods of aircraft control, Babs and Gee. For another account see *Electrician*, 13th Sept. 1946, Vol. 137, No. 3563, p. 718.

621.396.933.2 **113**
On the Error in the Determination of the Median Plane of a Radio Beacon in a Tilted Airplane.—K. F. Niessen. (*Philips Res. Rep.*, April 1946, Vol. 1, No. 3, pp. 161–168.) The electric field from a vertical radiator situated on the ground has a radial as well as a vertical component at an elevated receiving point such as an aircraft. The effect of this on the accuracy of air navigation systems having spaced vertical radiators is considered. It is shown that bearing errors will occur if the aircraft aerial responds to non-vertical electric fields, *e.g.* when the aircraft banks.

621.396.9(02) **114**
Introduzione alla Radiotelemetria (Radar). [Book Review]—U. Tiberio. Editore Rivista Marittima, Rome, 1946, 277 pp., 300 lire. (*Nature, Lond.*, 31st Aug. 1946, Vol. 158, No. 4009, pp. 288–289.) " . . . an account of the Italian research on radar from 1935 until the end of hostilities. The treatment [of elementary principles] is simple and lucid."

621.396.932(02) **115**
Radio Aids to Navigation. [Book Notice]—[U.S.] Hydrographic Office Publ. No. 206, 1946, 463 pp., $2.00. (*U.S. Govt Publ.*, June 1946, No. 617, p. 667.)

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **116**
An Easily Constructed All-Metal Vacuum Gauge.—R. T. Webber & C. T. Lane. (*Rev. sci. Instrum.*, Aug. 1946, Vol. 17, No. 8, p. 308.)

531.788.7 **117**
Radio-Active Ionization Gauge.—National Research Corporation. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, p. 247.) The replacement of the usual hot filament by a radium pellet as a source of ionization results in a smaller liability to zero drift and the coverage of a greater range of pressure. There is a loss of sensitivity at low pressures.

533.5 **118**
A Vacuum 'Lead-in'.—H. Herne. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, p. 244.) A current of up to 50 A had to be passed through a metal base-plate into a high vacuum chamber. A metal-rubber anti-vibration bush was used as an insulator; the outer metal cylinder of the bush was soft-soldered to the base plate, and the inner one to a solid conductor which would carry the required current.

533.5 : 621.3.032.53 **119**
Theory and Practice of Glass-Metal Seals: Parts 1-3.—A. J. Monack. (*Glass Ind.*, Aug.–Oct. 1946, Vol. 27, Nos. 8–10, pp. 389..420, 446..476 & 502..528.)

535.37 : 535.61–15 **120**
Development of Infra-Red Sensitive Phosphors.—B. O'Brien. (*J. opt. Soc. Amer.*, July 1946, Vol. 36, No. 7, pp. 369–371.)

535.37 : 535.61–15 **121**
On Infra-Red Sensitive Phosphors.—F. Urbach, D. Pearlman & H. Hemmendinger. (*J. opt. Soc. Amer.*, July 1946, Vol. 36, No. 7, pp. 372–381.)

535.37 : 535.61–15 **122**
Preparation and Characteristics of Zinc Sulfide Phosphors Sensitive to Infra-Red.—G. R. Fonda. (*J. opt. Soc. Amer.*, July 1946, Vol. 36, No. 7, pp. 382–389.)

535.371.07 : 621.385.832 **123**
Long Persistence C.R. Tube Screens.—R. Feldt. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 70–71.) A comparison of the persistence of the trace in DuMont tubes with the P^2 screen (green single layer) and the P^7 screen (blue ZnS.Ag and yellow ZnCdS.Cu) under various conditions of voltage, writing speed and ambient illumination. Curves and a table of results are given.

537.226 : 62 **124**
Theoretical Physics [of dielectrics] **in Industry.**—H. Fröhlich. (*Nature, Lond.*, 7th Sept. 1946, Vol. 158, No. 4010, pp. 332–334.) The behaviour of electrons in crystalline solids is discussed theoretically with particular reference to the properties of dielectrics. In insulators the occupied energy bands in the atoms are completely filled, while conduction in metals is associated with incompletely filled bands. Dielectric breakdown occurs when electrons are continuously raised to higher energy levels until internal ionization occurs. Dielectric strength increases with temperature up to a critical temperature at which collisions between electrons become important; dielectric strength decreases with further temperature increase. Dielectric loss is due to the phase lag between the motion of elementary dipoles and the applied field.

537.226.3 + 621.315.611.011.5 **125**
The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Solid Dielectrics: Part 1.—M. Gevers. (*Philips Res. Rep.*, April 1946, Vol. 1, No. 3, pp. 197–224.) "The ratio of the temperature coefficient to . . . tan δ at a given temperature and frequency is nearly the same for most solid dielectrics." This cannot be explained by existing theories, such as those of Pellat, von Schweidler, Wagner, Debye, Gyemant and others which are summarized. A bibliography of 44 items is given. Later articles will describe the experimental technique, and give a theoretical explanation of the result quoted.

538.22 : 546.77 **126**
Magnetic Anisotropy of Molybdenite at Different Temperatures.—A. K. Dutta. (*Indian J. Phys.*, Dec. 1945, Vol. 19, No. 6, pp. 225–234.)

538.652 : 62 **127**
Magnetostriction in Industry Processes.—F. Sloane. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 74–76, 101.) A general survey of the physical principles, and of magnetostriction oscillators.

538.662.13 : 537.228.1 **128**
The Lower Curie Point of Ferro-Electric Salts.—H. M. Barkla. (*Nature, Lond.*, 7th Sept. 1946, Vol. 158, No. 4010, pp. 340–341.) In a constant electric field the electric moment of ferro-electric

salts analogous to potassium dihydrogen phosphate remains unchanged in passing through the lower Curie point.

546.287 **129**
Take a Grain of Sand.—H. C. E. Johnson. (*Sci. Amer.*, Sept. 1946, Vol. 175, No. 3, pp. 105–107.) Elementary survey of silicones and their uses in liquid, rubber or resin form.

546.621 : 620.193.2 **130**
Study of the Oxidation of Aluminium by Air at Ordinary Temperatures, by measuring the Potential of [electrolytic] **Dissolution.**—P. Morize & P. Lacombe. (*C. R. Acad. Sci., Paris*, 18th March 1946, Vol. 222, No. 12, pp. 658–659.) For pure electrolytically-polished aluminium the potential is − 1.20 V. Exposure to air causes a fall which increases with time at a rate dependent on atmospheric humidity: the value of the potential indicates the thickness of the oxide layer.

546.72 **131**
Preparation and Magnetic Properties of the Compound Fe_4N.—C. Guillaud & H. Creveaux. (*C. R. Acad. Sci., Paris*, 13th May 1946, Vol. 222, No. 20, pp. 1170–1172.)

551.582 : 620.19 **132**
Climate and the Deterioration of Materials.—C. E. P. Brooks. (*Quart. J.R. met. Soc.*, Jan. 1946, Vol. 72, No. 311, pp. 87–97.) The relation of air temperature to that of exposed surfaces or containers is explained. Temperature and moisture effects on materials are considered in general terms, and a rough index of their relative seriousness in various regions is plotted on a world chart.

620.197(213) : 621.396.6.045 **133**
Tropicalizing [transformers and chokes].—O. P. Scarff. (*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 312–313.) See also 134 below.

620.197(213) : 621.314.045 **134**
Impregnated Windings [for tropicalizing transformers].—T. Williams: R. Burkett. (*Wireless World*, Oct. 1946, Vol. 52, No. 10, pp. 345–346.) Correspondence on 133 above.

621.314.63 **135**
Metal Rectifier Developments — Possible Applications of Titanium Dioxide.—Henisch. (*See* 248.)

621.315[.211.2 + .22 **136**
Mineral-Insulated Metal-Sheathed Conductors.—Tomlinson & Wright. (*See* 12.)

621.315.6 + [621.39 : 371.3 **137**
I.E.E. Radio Section Address : Part 1 — Training Courses ; Part 2 — Dielectric Developments.—Jackson. (*See* 314.)

621.315.61 **138**
The Transformation of Anatase into Rutile.—T. Nguyen. (*C.R. Acad. Sci., Paris*, 13th May 1946, Vol. 222, No. 20, pp. 1178–1179.)

621.315.612.3.029.6 **139**
Steatite for High Frequency Insulation.—J. M. Gleason. (*J. Brit. Instn Radio Engrs*, Jan./Feb. 1946, Vol. 6, No. 1, pp. 20–32.) Reprint of 3059 of 1945.

621.315.617.3 **140**
Film-Forming Materials used in Insulation.—(*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, p. 344.) Report of I.E.E. Radio Section discussion led by C. R. Pye: for other accounts see 641 and 352 of 1946.

621.316.86 : 546.281.26 **141**
Silicon Carbide Non-Ohmic Resistors.—F. Ashworth, W. Needham & R. W. Sillars. (*J. Instn elect. Engrs*, Part I, Sept. 1946, Vol. 93, No. 69, pp. 385–401. Discussion, pp. 401–405.) An integrating paper, discussing the properties and construction of these resistors, and the characteristics of single contacts between silicon carbide crystals. A method of calculating currents and voltages in circuits involving these resistors is given in an appendix, and their uses, limitations, and specification are considered.

621.357.1 : 620.192.43 **142**
Electrolytic Detection of Small Amounts of Lead in Brass or Zinc.—D. McLean. (*Nature, Lond.*, 31st Aug. 1946, Vol. 158, No. 4009, p. 307.) The local cell set up between the lead and the groundmass during electrolytic polishing produces a ‘ moat ’ around the lead particles which can be identified microscopically.

621.357.8 : 669.018.2.21 **143**
Anodizing and Its Uses in Engine Construction.—N. D. Tomashov. **After Treatment of Aluminium-Alloy Castings.**—E. Carrington. **Anodizing — A Commentary.**—P. Smith. (*Light Metals*, Aug. & Oct. 1946, Vol. 9, Nos. 103 & 105, pp. 429–438, 439–450 & 515–516.)

666.1 : 62 **144**
New Glass Compositions for Industry.—(*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, p. 299.) Note on recent work by the British Thomson-Houston Co. on glasses for the lamp and radio valve industry, including “ C40 ” for sealing to Kovar, a leadless glass for sealing to iron, and phosphate glasses. Expansion viscosity and annealing properties are also being fundamentally investigated.

669 + 546.3 **145**
Electrons and Metals : Part 2 — The Nature of a Metal.—W. Hume-Rothery. (*Metal Ind., Lond.*, 25th Oct. 1946, Vol. 69, No. 17, pp. 343–346.) Twenty-fifth instalment of a series; written as a discussion between a young scientist and an older metallurgist on co-valent bonds.

669 : 061.6 **146**
Metallurgical Research.—(*Electrician*, 25th Oct. 1946, Vol. 137, No. 3569, pp. 1139–1140.) An account of a new laboratory built at the Bilston works of Joseph Sankey Ltd. for research on cold-rolling processes, the fundamental nature of ferromagnetism, testing of sheet steels, and production control.

669.295/.296 **147**
Titanium and Zirconium.—W. J. Kroll & A. W. Schlechten. (*Metal Ind., Lond.*, 18th Oct. 1946, Vol. 69, No. 16, pp. 319–322.) Properties and extraction methods.

669.35.5.55 **148**
Electrical Resistance Alloy.—(*Engineering, Lond.*, 30th Aug. 1946, Vol. 162, No. 4207, p. 211.) The

physical properties of a new copper base resistance alloy 'Kumanal'. Its specific resistance is 41×10^{-6} Ω.cm and varies little between 20°C and 350°C.

679.5 **149**

Polytetrafluoroethylene.—M. M. Renfrew & E. E. Lewis. (*Industr. Engng Chem.*, Sept. 1946, Vol. 38, No. 9, pp. 870–877.) A full account of the electrical, mechanical and chemical properties of this new plastic. It will withstand 300°C and is not brittle at low temperatures. The dielectric constant is 2.0 and the power factor less than 0.000 2 at frequencies up to 3 000 Mc/s. When subject to an electric arc the plastic does not form a conducting carbon track but is reduced to a volatile gas. It is used for h.f. electrical insulation and in equipment for handling hot corrosive liquids.

679.5 **150**

Progress in Plastics: Parts 1 & 2.—A. E. Williams. (*Engineer, Lond.*, 6th & 13th Sept. 1946, Vol. 182, Nos. 4730 & 4731, pp. 206–207 & pp. 229–232.)

681.2.085 : 621.972.6 **151**

Improved Methods of Illuminating Instrument Dials.—H. Huxley. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, pp. 234–237.) Methods involving the leading of light in perspex can be used to give maximum uniformity of dial illumination with minimum extraneous light.

621.315.614.72(02) **152**

Varnished Cloths for Electrical Insulation. [Book Review]—H. W. Chatfield & J. H. Wreddon. J. & A. Churchill, London, 1946, 255 pp., 21s. (*Gen. elect. Rev.*, Sept. 1946, Vol. 49, No. 9, p. 62; *Wireless World*, Sept. 1946, Vol. 52, No. 9, p. 307.) One of the authors is employed by a varnish manufacturer, and the other by an electrical manufacturer. See also 3648 of 1946.

MATHEMATICS

512.52 **153**

Interpolation with the Aid of a Plot of First Differences.—G. S. Fulcher. (*J. appl. Phys.*, July 1946, Vol. 17, No. 7, pp. 617–628.)

518.5 **154**

Differential Analyzer.—(*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 62–66..100.) A general description, with photographs, of the Massachusetts Institute of Technology equipment. Mechanical integrators are used with servo-operated capacitor bridges for transmitting the information electrically between integrators. Punched tape is used for automatic control of the equipment. For a full description see 361 of 1946.

518.61 **155**

Calculation of the Electromagnetic Field, Frequency and Circuit Parameters of High-Frequency Resonator Cavities.—Motz. (*See* 52.)

518.61 **156**

Calculation of the Magnetic Field in Dynamo-Electric Machines by Southwell's Relaxation Method.—H. Motz & W. D. Worthy. (*J. Instn elect. Engrs*, Part II, Aug. 1946, Vol. 93, No. 34, pp. 379–382.) Discussion of 658 of 1946.

519.2 **157**

On the Location of a Point on a Plane by Cross Bearings from Three Known Points.—Yudin. (*See* 103.)

519.2 **158**

The Resultant of a Large Number of Events of Random Phase.—Domb. (*See* 278.)

519.241.6 : 621.3 **159**

An Extension of Campbell's Theorem of Random Fluctuations.—Rivlin. (*See* 29.)

534.014.2 : 621.396.611 **160**

An Experimental Investigation of Forced Vibrations in a Mechanical System having a Non-Linear Restoring Force.—Ludeke. (*See* 53.)

621.317.727 : 514 **161**

A Simple Potentiometer Circuit for Production of the Tangent Function.—R. Hofstadter. (*Rev. sci. Instrum.*, Aug. 1946, Vol. 17, No. 8, pp. 298–300.)

51(075) : 621.396 **162**

Basic Mathematics for Radio Students. [Book Review]—F. M. Colebrook. Iliffe & Sons, London, 1946, 270 pp., 10s. 6d. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, p. 293.) ". . . the subject is presented with the lucidity we expect from this well-known contributor to radio technical journals." See also 3338 of 1946.

518.2(083) : 517.564.4 **163**

Tables of Associated Legendre Functions. [Book Review]—Mathematical Tables Project. Columbia Univ. Press, New York, 1945, 303 pp., $5.00. (*Phil. Mag.*, Oct. 1945, Vol. 36, No. 261, pp. 729–730.) See also 1279 of 1946.

519.21(02) **164**

An Experimental Introduction to the Theory of Probability. [Book Review]—J. E. Kerrich. Einar Munksgaard, Copenhagen, 1946, 98 pp., 8.50 kroner. (*Nature, Lond.*, 14th Sept. 1946, Vol. 158, No. 4011, p. 360.)

MEASUREMENTS AND TEST GEAR

538.12 : 621.3.08 **165**

Production of Uniform and Constant Magnetic Fields for Measurement Purposes: Parts 1 & 2.—H. Neumann. (*Arch. tech. Messen*, Nov. & Dec. 1940, Nos. 113 & 114, pp. T128–129 & T138–139.) Parts 3 & 4 were noted in 2823 of 1942.

538.214.082.1 **166**

Apparatus for Measuring Magnetic Moments.—G. N. Rathenau & J. L. Snoek. (*Philips Res. Rep.*, April 1946, Vol. 1, No. 3, p. 239.) The specimen whose susceptibility is required is suspended in a magnetic field such that the restoring force on the specimen for small displacements is proportional to the displacement. Measurement of the period of oscillation with and without the magnetic field enables the susceptibility to be deduced.

549.514.51 : 620.1 **167**

Quartz Crystal Testing Instrumentation.—D. S. Dickey. (*Instruments*, Jan. 1946, Vol. 19, No. 1, pp. 9–11.) Describes the use of recording instruments for production testing of the variation of crystal frequency and activity with temperature.

621.317 **168**

The History and Development of the British Scientific Instrument Industry.—Barron. (*See* 315.)

621.317 : 621.396.6.004.67(73) **169**

Measuring Equipment in American Radio Repair Workshops : Parts 1 & 2.—G. Keinath. (*Arch. tech. Messen*, Nov. & Dec. 1940, Nos. 113 & 114, pp. T120 & T132–133.) The noteworthy features of this equipment are (i) flexibility, (ii) limited accuracy, (iii) convenience in use, (iv) portability, and (v) cheapness. The article considers in some detail with diagrams and circuits : (*a*) high resistance d.c. voltmeters, (*b*) capacitance meters, (*c*) valve testers, (*d*) vibrator testers, (*e*) test oscillators, (*f*) universal receiver tester and (*g*) oscilloscopes.

621.317.2 : 621.396.623 **170**

Notes on Field Laboratory Design.—Matthews. (*See* 228.)

621.317.2 : 621.397.5 **171**

TV [television] **Test Equipment.**—Hunter. (*See* 268.)

621.317.2 : 621.397.5 **172**

A Television Pattern Test Generator.—Inskip. (*See* 267.)

621.317.3 : 621.392 **173**

Waveguide Measurements.—G. Ashdown. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 318–319.) A description of a 10 000-Mc/s waveguide test-bench whose main components are : a short length of waveguide carrying a klystron oscillator, a launching aerial, a 10-db attenuator, a coaxial-line wavemeter and a standing-wave detector.

621.317.33 : 621.315.21.029.4/.6 **174**

Characteristics of R.F. Cables.—N. C. Stamford & R. B. Quarmby. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 295–298.) A technique of measurement at 600 Mc/s, for coaxial or twin cables, developed at Manchester University. The cable is magnetically coupled to an oscillator at one end and left open at the other. The variations of input current, measured by a thermojunction, are observed as short lengths are cut from the open end. The phase constant is then determined from the lengths at which successive minima of current occur. The attenuation constant is found by comparing the outputs of short and long line lengths for equal inputs when the power measuring device is matched to the line. Characteristic impedance is measured by substituting a $\lambda/4$ section of air-spaced coaxial line whose characteristic impedance is varied (by variation of the diameter of the inner conductor) until the matched condition is restored.

621.317.33.029.63 : 621.315.2 **175**

The Measurement of Cable Characteristics at Ultra-High Frequencies.—F. Jones & R. Sear. (*J. Brit. Instn Radio Engrs*, Aug./Sept. 1945, Vol 5, No. 4, pp. 154–169. Discussion, pp. 170–172.) " The paper describes the two main methods of impedance measurement at frequencies above 100 Mc/s which are in general use, and their application to the determination of cable characteristics, with particular attention to the work of the authors.

" A preliminary account is given of the various conditions in which cables can be measured, and which are applicable to both of the methods described.

" An outline of the theory of the standing wave method is given, together with a general description of the equipment required. Attention is paid to coned connectors for the attachment of the cable to the measuring line, and the errors liable to be incurred by their use.

" The theory and equipment for the resonance line method are described, and an account is given of several investigations that have been conducted in order to extend its usefulness. These include the measurement of twin cables, the effect on cable attenuation values of reactive discontinuities at the junction of measuring line and cable and at internal supports in the line, the direct determination of the characteristic impedance of measuring lines, and the radiation and reactive effects which occur at their open ends.

" The application of the resonance line method to the determination of dielectric power factor is discussed, and a method is described which permits greater accuracy than has been obtained up to the present."

621.317.372 : 621.315.2 **176**

End Leakage in Cable Power-Factor Measurement.—A. Rosen. (*J. Instn elect. Engrs*, Part II, Aug. 1946, Vol. 93, No. 34, pp. 383–386.) In d.c. measurements of the insulation resistance of cables a simple guard wire is used to eliminate the effects of leakage at the cable ends. This guard wire has been modified to make it effective for a.c. measurements when used in conjunction with a suitable bridge ; end leakage error is thereby completely avoided.

621.317.374.029.6 **177**

A Microwave Dielectric Loss Measuring Technique.—W. R. MacLean. (*J. appl. Phys.*, July 1946, Vol. 17, No. 7, pp. 558–566.) The dielectric loss is measured by determinations of the *Q*-factor of a resonator partially filled with the sample. The method is restricted to the determination of small loss factors, and requires a preliminary approximate determination of the dielectric constant. The sample is placed inside the resonator as a dielectric core which confines the field almost entirely to the dielectric. Double sample technique is used to eliminate dominant spurious losses. Detuning for the half-power points in the determination of the *Q*-factor is accomplished by large movement of a small rod, whose characteristics as a tuning element can be calculated.

621.317.374.029.6 **178**

A New Method for Measuring Dielectric Constant and Loss in the Range of Centimeter Waves.—S. Roberts & A. von Hippel. (*J. appl. Phys.*, July 1946, Vol. 17, No. 7, pp. 610–616.) The closed end of a rectangular waveguide is covered by a slab of the material, the dielectric constant of which is deduced from measurements of the standing-wave pattern in the guide, determined by means of a sliding crystal-valve probe. Certain previous sources of error are eliminated in this method. The paper gives a description of the apparatus, the theory of the method, and results for various solid and liquid dielectrics at 25°C for $\lambda = 6$ cm.

621.317.374 : 519.283 **179**

Quality Control [of dielectric material] **by means of H.F. Currents.**—P. Toulon. (*C. R. Acad. Sci., Paris*, 4th March 1946, Vol. 222, No. 10, pp. 543–544.) Describes methods of measurement of dielectric loss by means of a Q-meter.

621.317.384 : 621.314.2 **180**

A Device for the Measurement of No-Load Losses in Small Power Transformers.—L. Medina. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1946, Vol. 7, No. 9, pp. 13–16.) The magnetizing component of the exciting current is cancelled by means of a variable shunt capacitance, and the no-load loss current is measured by a rectifier-type microammeter in conjunction with a filter arrangement tuned to the fundamental frequency of the supply voltage. It is a method for production testing and the accuracy is 5–10% ; circuit details are given for a practical instrument.

621.317.7 **181**

Developments in Electrical Measuring Instruments.—(*Engineering, Lond.*, 6th Sept. 1946, Vol. 162, No. 4208, pp. 234–235.) Comment on 3351 of 1946.

621.317.7.082.7.029.63 : 621.315.212 **182**

Standing-Wave Indicator.—G. E. Feiker. (*Gen. elect. Rev.*, Sept. 1946, Vol. 49, No. 9, pp. 43–46.) The indicator consists of a slotted section of coaxial line with an adjustable outer conductor so that a probe may be driven by a rack and pinion arrangement along the line. Its operating frequency is of the order of 3 000 Mc/s. Methods are explained for using it to measure (*a*) standing wave ratio, (*b*) complex impedance, (*c*) net power flow, (*d*) attenuation.

621.317[.72 + .784 **183**

A Precision A.C./D.C. Comparator for Power and Voltage Measurements.—G. F. Shotter & H. D. Hawkes. (*J. Instn elect. Engrs*, Part II, Aug. 1946, Vol. 93, No. 34, pp. 314–319. Discussion, pp. 320–324.) The sources of error common to dynamometer wattmeters are briefly reviewed, and a new instrument for measuring a.c. power and voltage by direct comparison with a standard d.c. potentiometer is described.

621.317.727 **184**

Self Balancing Potentiometer.—(*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, p. 79.) A ' slide back ' arrangement using a galvanometer and a double photocell in a valve bridge circuit, drawing less than 0.01 μA from the source. It measures potentials between 100 μV and 1 V ; it will produce a maximum drop of 10 V across an output load of 2 000 Ω.

621.317.733 : 621.326 **185**

A Method of Measuring the Current Distortion and Phase-Angle due to a Non-Linear Impedance.—G. M. Petropoulos. (*Beama J.*, Sept. 1946, Vol. 53, No. 111, pp. 320–323.) A sinusoidal voltage is applied and a suppression method using a Wheatstone bridge arrangement is employed. The non-linear impedance of incandescent lamps causes current distortion, the distortion factor and phase-angle increasing with applied voltage, but its magnitude is not considered of practical importance.

621.317.76 **186**

A Standard of Frequency and Its Applications.—C. F. Booth & F. J. M. Laver. (*J. Instn elect. Engrs*, Part I, Sept. 1946, Vol. 93, No. 69, pp. 417–418.) Summary of 2973 of 1946.

621.317.784.029.6 **187**

Air-Flow U.H.F. Watt-Meter.—Z. W. Wilchinsky & R. H. Kyser. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 128–129.) " Description of a laboratory-type instrument, suitable for calibration of general-purpose wattmeters. A tungsten-filament dissipative element [in an evacuated envelope] is inserted as the central conductor in a section of coaxial transmission line." The operating wavelength is about 30 cm at power levels up to about 20 W. The temperature rise of the air passing the load is measured by thermocouples. Calibration at mains frequency is recommended. The chief drawback of the instrument is " that several minutes may be required for a steady state to be obtained ".

621.317.79 : 621.396.9 **188**

Production of Airplane Radar speeded by New Testing Technique.—F. P. Wight. (*Bell Lab. Rec.*, Sept. 1946, Vol. 24, No. 9, pp. 330–334.) Description of test apparatus and methods designed by the Western Electric Laboratories as an integral part of the production programme for certain airborne radar units. The tests included determination of wave shapes, amplitudes, frequencies, and bandwidths, and checks of general circuit performance and mechanical alignment.

621.317.794.029.6 **189**

Bolometers for V.H.F. Power Measurement.—E. M. Hickin. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, pp. 308–313.) " In this method the power is dissipated in a resistor having a large temperature coefficient (an ' indicator ') which forms one arm of a Wheatstone bridge. By direct-current power substitution the indicator may be calibrated and then one measurement of resistance will give the power in the load.

" Some details are given of indicators and circuits to deal with powers from a few microwatts to a few watts at frequencies up to 10 000 Mc/s. The limitations of the method and possible sources of error are discussed."

The construction of power indicators is treated in detail : the CV 95 using a 0.01-mm tungsten wire *in vacuo*, or in an inert gas to a given increased power rating, and the possible use for the filament of Wollaston wire (Pt coated with Ag), carbon or iron is described.

621.362 **190**

Schwarz Thermopiles.—A. Hilger Ltd. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, p. 246.) A new design, said to have unusually high sensitivity and speed and to be more robust than previous types.

621.384.5.08 **191**

The Properties of Glow Tubes and their Applications for Measurement Purposes.—A. Glaser. (*Arch. tech. Messen*, Dec. 1940, No. 114, pp. T136–137.)

621.392.43.082.7 **192**

Note on a Reflection-Coefficient Meter.—Korman. (*See* 18.)

621.396.61[.62].016.2.081.4.029.6 **193**

Specification of Receiver Sensitivity and Transmitter Power Output at Ultra-High Frequencies.—L. S. Schwartz. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, p. 663.) Plea for specifying receiver sensitivity in terms of decibels below 1 W and for calibrating signal generators in terms of available power. Similarly transmitter power may, for consistency, be specified in decibels above 1 W.

621.396.611.21 : 529.78 **194**

The Measurement of Time.—H. Spencer Jones. (*Endeavour*, Oct. 1945, Vol. 4, No. 16, pp. 123–130.) Includes an account of the applications of crystal clocks at the Royal Observatory. Their advantages and disadvantages compared with other types are discussed. The need for operating crystal clocks in groups with regular intercomparison is stressed. A 'decimal counting chronometer' with a 10-μs unit of time is briefly described. See also 3388 of 1946 (Booth).

621.396.615.11 **195**

Thermistor-Regulated Low-Frequency Oscillator.—L. Fleming. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 97–99.) Design considerations and detailed description of a phase-shift oscillator covering the frequency range 0.9 to 10 000 c/s in four bands. A direct-coupled cathode follower is included in the feedback chain, and a separate cathode follower is used at the output stage. The feedback thermistor has a time constant of about one second, which sets the low limit to the frequency range covered.

621.317.733.025(02) **196**

Alternating Current Bridge Methods. [Book Review]—B. Hague. Pitman, London, 6th edn 1945, 616 pp., 30s. (*Beama J.*, Sept. 1946, Vol. 53, No. 111, p. 329.) "This new edition, like its predecessors, should be in the hands of all engineers and students who have an interest in bridge methods."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.714.7 : 621.317.39 **197**

Electronic Micrometer for Thin Materials.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 190..198.) Permits continuous production measurement of wire diameter and strip thickness. The material passes an aperture illuminated by a scanning spot which throws a shadow on a photocell. The size of the shadow determines the voltage signal in the load resistor of the photocell.

535.61–15 **198**

Radioactive Infrared Detector.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 142, 146.) Radioactive material contained in the detector charges a viewing screen and makes it sensitive to incoming infrared radiation reflected on to it by a periscope device It permits the detection of infra-red radiation but not the identification of objects.

621.314.67 : 621.385.38 : 621.365 **199**

Grid-Controlled Rectifiers for R.F. Heating.—B. Boyd. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 125–127.) Control of the d.c. output voltage is obtained by varying the phase of an auxiliary a.c. supply on the thyratron grid. The application of this control system to a 100-kW power supply is described.

621.316.578.1 : 774 **200**

A Timer for Photo-Printing.—N. Phelp & F. Tappenden. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 300–301.) A two-valve electronic switch is "controlled by the exponentially decreasing potential difference across the terminals of a capacitance shunted by a discharging resistance," whose value determines the exposure time.

621.316.923 : 623.95 **201**

Fuzes for Electronic [magnetic] **Mines.**—(*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 162, 166.)

621.317.39 **202**

The "Aquatector".—(*Electrician*, 18th Oct. 1946, Vol. 137, No. 3568, pp. 1073–1074.) Brief description of the performance of two instruments for the accurate detection and measurement of the moisture content in a wide range of solid materials and emulsions.

621.317.75.029.3 **203**

A Frequency Analyser used in the Study of Ocean Waves.—N. F. Barber, F. Ursell, J. Darbyshire & M. J. Tucker. (*Nature, Lond.*, 7th Sept. 1946, Vol. 158, No. 4010, pp. 329–332.) The records of water pressure with which the analyser is fed are in the form of a black trace of variable width on a white background. Such a record is attached to the perimeter of a wheel 30 inches in diameter which is rotated at a speed of several revolutions per second and scanned by a photocell. The amplified output from the photocell is fed to a vibration galvanometer, the motion of which is recorded on a trace forming the frequency spectrum. As the speed of rotation of the wheel is allowed to diminish continuously and naturally under the action of friction, the various frequency components present in the original record 'glide' in turn through the resonant frequency of the galvanometer. Satisfactory resolution of harmonics up to the order of sixty has been achieved.

621.365.5 **204**

Volman-Stivin High-Frequency Induction Hardening Machines.—(*Machinery, Lond.*, 17th Oct. 1946, Vol. 69, No. 1775, pp. 498–500.) Automatic or semi-automatic machinery for hardening special alloy-steel and carbon-steel components by induction heating methods. Plant is available with powers up to 200 kW for handling work ranging from small components up to workpieces four feet in length such as crankshafts and camshafts.

621.365.5 : 621.3.018.41 **205**

The Effect of Frequency in Induction Heating.—R. A. Nielson. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 320–322.) A simple approximate formula is derived for the power dissipation in a cylinder heated in a long solenoid. Increasing frequency decreases the necessary current or number of turns. The limitation is occurrence of arcing.

621.38.001.8 **206**

Electronics — Servant or Fad?—Weiller. (*See* 318.)

621.38.001.8 **207**

[Electronic] **Machine-Tool Contour Controller.**—J. M. Morgan. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 92–96.)

621.38.001.8 : 551.576 **208**

Remote Cloud Indicator.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, p. 162.) Instrument developed in Britain for attaching to a barrage balloon to indicate when the balloon is flying in cloud. Strips of metal foil separated by very thin mica sheets are bridged by moisture when in cloud, thus firing a thyratron operating a transmitter.

261.38.078 : 538.56.029.6 **209**

Will Industrial Electronic Control use Microwaves?—W. C. White. (*Gen. elect. Rev.*, Sept. 1946, Vol. 49, No. 9, pp. 8–11.) A simple r.f. oscillator is described, consisting of a cavity resonator with output up to 1 W at a frequency of 3 000 Mc/s, together with a detector unit comprising a half-wave dipole, silicon crystal detector, and microammeter.

Demonstration technique is then discussed for (*a*) directivity and propagation through metallic and non-metallic objects, (*b*) reflection and polarization, (*c*) standing waves, and (*d*) use of waveguides.

The object is to make properties peculiar to microwaves more familiar to non-radio engineers: their application will probably be similar to that of present photoelectric relay devices.

621.383.001.8 : 535.61–15 **210**

The Development of Infra-Red Technique in Germany.—V. Křižek & V. Vand. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 316–317.. 322.) Resistance photocells were thought to be the best type of detector. Thallium sulphide or lead sulphide are the best materials for wavelengths up to 5 μ. An infra-red image projected on a photocathode could be converted into a visible image on a fluorescent screen. An infra-red iconoscope used a semiconducting layer whose resistance changed with the intensity of illumination. An 'electron mirror' is also described. These infrared devices will probably be appreciably cheaper than radar equipment for safeguarding transport against collision.

621.385.38.078 **211**

Simplified Thyratron Motor Control.—H. H. Leigh. (*Gen. elect. Rev.*, Sept. 1946, Vol. 49, No. 9, pp. 18–27.) Basic types of control are explained, and typical applications specified.

621.396.611.21 : 529.78 **212**

The Measurement of Time.—Jones. (*See* 194.)

621.396.619.018.41 : 621.384 **213**

Mechanical Frequency Modulation System as applied to the Cyclotron.—F. H. Schmidt. (*Rev. sci. Instrum.*, Aug. 1946, Vol. 17, No. 8, pp. 301–306.)

621.396.9 : 623.26 **214**

Metal Detectors.—Cinema-Television Ltd. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, pp. 244–245.) An adaptation of the Mark IV mine detector involving eddy-current or magnetic coupling between two coils.

621.396.9 : 629.135.053.2 **215**

Radio-Beam Speedometer for Aircraft.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, p. 170.) The times at which the aircraft crosses three parallel radar beams at right angles to its path are signalled to a central recording station. The aircraft speed is deduced from the known distance between the beams.

622.19 : 621.396 **216**

The Propagational Method of Radio Prospecting : A. — Subterranean Methods.—V. Fritsch. (*Arch. tech. Messen*, Dec. 1940, No. 114, pp. T134–135.) The measurement of the absorption of radio waves passing through or into a mountain provides information on the properties (conductivity and dielectric constant) of the material. The propagation path is chosen to be about 100 m for rocks of good conductivity and may be longer for materials such as granite. The variation of relative field-strength with frequency provides the 'radio-geological curve' which usually has a minimum at some frequency which depends on the material.

The effects of geological inhomogeneities and of the disposition of the transmitter and receiver (with particular reference to multiple propagation paths) are discussed. A brief reference to the reflection method of measurement is made. See also 3710 of 1946.

621.365.5(02) **217**

High-Frequency Induction Heating. [Book Review]—F. W. Curtis. McGraw-Hill, New York, 1944, 235 pp., 249 figs., 16s. 6d. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, p. 324.) ". . . a thoroughly practical, lavishly illustrated work which incorporates all the major developments of recent years."

PROPAGATION OF WAVES

621.396.11 + 535.13 **218**

On an Interpretation of the Propagation of E.M. Waves and Its Consequences.—A. Haubert. (*C.R. Acad. Sci., Paris*, 4th March 1946, Vol. 222, No. 10, pp. 539–541.) Schelkunoff's concept of the characteristic impedance of a medium (see 803 of 1938) has suggested the author's consideration of atmospherics in terms of the waveguide formed by the ground and the ionosphere.

Formulae for reflection and transmission coefficients at a boundary between two media are derived, which by use of complex quantities can be extended to conducting media, but only reduce to the Fresnel formulae when the media are dielectrics of equal permeability. The conception of the apparent permittivity of an ionized gas can be replaced by that of a uniformly distributed shunt admittance.

621.396.11.029.64 + 535.343.4 **219**
+ 538.569.4.029.64] : 551.57

The Absorption of 1-cm Electromagnetic Waves by Atmospheric Water Vapor.—R. L. Kyhl, R. H. Dicke & R. Beringer. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 694.) The position (1.34 cm) and width (0.11 cm^{-1}) of the absorption line were determined using a radiometer due to R. H. Dicke. These results agree with Van Vleck's predictions but the absolute absorption is greater. See also 3396 of 1946 (Beringer). Summary of Amer. Phys. Soc. paper.

621.396.11 : 551.510.535 **220**

The Effect of the Ionosphere on Radio Communication.—R. W. E. McNicol. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1946, Vol. 7, No. 8, pp. 14–20.) A very general lecture on the formation and structure of the ionosphere, and the choice of radio frequency for transmitting under prevailing conditions. Measurements of ionospheric characteristics, such as virtual height, critical frequency and absorption are briefly discussed, and illustrations of ionospheric storms and fade-out effects are included.

621.396.11 : 551.510.535 **221**

Short-Wave [ionospheric] **Forecasting.**—T. W. Bennington. (*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 292–295.) A continuation of 3721 of 1946 describing how the predicted average M.U.F. can be determined for a transmission path of any length, in any part of the world, for every hour of day for the month, from the contour charts compiled from the critical frequency measurements.

RECEPTION

621.396/.397].621.004.67 **222**

The Servicing of Radio and Television Receivers.—(*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 362–363.) Summary of I.E.E. Radio Section discussion led by R. C. G. Williams. It was considered that, while a good grounding in principles was essential for servicing technicians, familiarity with the practical technique of fault-finding was exceedingly important.

Standardization of components was desirable to reduce the number of parts a repairer had to stock. The provision by the manufacturer of more information in handbooks and circuit diagrams was suggested. Test equipment requirements were considered. See also 2686 of 1946.

621.396.62 **223**

Tendencies in the Design of the Communication Type of Receiver.—G. L. Grisdale & R. B. Armstrong. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 365–378. Discussion, pp. 378–384.) "A critical survey of the nature of the design problems and the solutions adopted in typical receivers, rather than . . . detailed design information in connection with any particular feature."

In general, superheterodyne circuits are used with one or two signal-frequency circuits and an i.f. of 400–700 kc/s. Double-superheterodyne circuits are also used and give improved image-signal rejection characteristics.

The problem of input coupling for obtaining optimum signal/noise ratio is considered and treated mathematically in an appendix and it is found that optimum conditions exist when the first circuit impedance is greater than the aerial feeder impedance. Curves are given of noise factor in terms of receiver input impedance, aerial impedance and detune ratio.

Consideration is given to the design of the frequency-change oscillator to minimize frequency instability due to variation of supply voltage and changes in circuit parameters due to humidity, temperature and mechanical vibration.

Among other topics discussed are the i.f. circuit (including crystal resonator circuits), the l.f. circuit, automatic gain control and noise limiter systems, crystal calibrators, electrical band-spreading and power supply systems.

Future developments are considered to include proofing against extremes of temperature, climatic and humidity variations, the reduction in size of components and receivers as a whole and increased facilities for performance checking.

621.396.621 **224**

Looking over the Postwar Receivers.—B.G. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 48–49.) A description of the receiver type RME–45 shows that it is " built along conventional lines : one stage of r.f. amplification, converter and two stages of i.f. amplification, with the crystal filter between the converter and first i.f. stage ; diode second detector, b.f.o., noise limiter, and two stages of audio amplification ".

621.396.621.53 **225**

Tubeless Converter for New F. M. Band.—H. A. Audet. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 140, 142.) F.m. receivers may be converted for the new 88–108 Mc/s band by using the original local oscillator to supply r.f. to the germanium crystal mixers to be added between the aerial and the first detector.

621.396.621.54 **226**

Superhet Tracking Formulas.—J. Marshall. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 202..214.) A method is explained for calculating with sufficient accuracy the capacitance and inductance values needed for packing and trimming various types of superheterodyne receiver. Design procedure is also explained in seven stages.

621.396.622 : 621.396.619.018.41 **227**

Single-Stage F.M. Detector.—W. E. Bradley. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 88–91.) The circuit comprises a special heptode valve, the first control grid and cathode of which form the electrodes of an oscillator arranged to give pulse output at i.f. A heavily damped tuned circuit in the anode circuit is reactively coupled to the oscillator, while the f.m. output from the i.f. chain is applied to the second control grid. It is shown that the mean anode current is amplitude-modulated with the intelligence contained in the f.m. signal.

621.396.623 : 621.317.2 **228**

Notes on Field Laboratory Design.—A. C. Matthews. (*Radio, N.Y.*, Aug. 1946, Vol. 30, No. 8, pp. 18–19.) Built to simulate the average user's home conditions as closely as possible, and equipped for testing and comparing receivers.

621.396.82.029.6 **229**

Elimination of Interference-Type Fading at Microwave Frequencies with Spaced Antennas.—R. Bateman. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1946, Vol. 34, No. 9, pp. 662–663.) This type of fading, due to tropospheric changes which alter the path length of the direct wave or the wave reflected from the ground, may be eliminated by diversity reception on suitably spaced aerials. An alternative scheme is to radiate a very narrow beam such that the wave reflected from the ground is small, or to use a system such that there is a gap between two lobes in the direction of the ground-reflected wave.

621.396.822 : 621.396.619.16 **230**

Pulse Distortion : the Probability Distribution of Distortion Magnitudes due to Inter-Channel Interference in Multi-Channel Pulse-Transmission Systems.—D. G. Tucker. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 323–334.) If the probability distribution of pulse distortion magnitudes in a multichannel pulse-transmission system is adequately considered, considerable economies in design may be made. An analysis of inter-channel interference distortion is given, and it is shown how to determine the probability distribution for interference of equal amplitudes from two adjacent channels on two or more links in tandem. On a typical multichannel v.f. telegraph system with two links in tandem, only about one pulse in a thousand is distorted more than half the maximum amount; the corresponding probabilities for other typical systems are much less. It is therefore evident that the basis of design should be not the maximum distortion but a fraction of it, perhaps between $\frac{1}{4}$ and $\frac{3}{4}$.

621.397.823 **231**

The Noise Suppressor in the V114 [television set].—Fairhurst. (*See* 274.)

STATIONS AND COMMUNICATION SYSTEMS

621.396.029.63/.64 **232**

Hyper-Frequency Radio.—J. M. A. Lenihan. (*J. Brit. Instn Radio Engrs*, Oct./Dec. 1944, Vol. 4, No. 3, pp. 178–186. Discussion, pp. 186–189.) A survey of problems and techniques involved at wavelengths below 30 cm, where conventional oscillators fail. The devices used include positive grid triodes, and cavity resonators. The principles of operation of these oscillators are outlined ; the most efficient and widely used are the klystron and the magnetron for which methods of modulation are given. Reception and the application of waveguides are briefly discussed, and future u.h.f. developments forecast. A selected bibliography of 33 items is given (p. 189).

621.396.1.029.6 : 523.2 **233**

Astronomical Radar.—Clarke. (*See* 106.)

621.396.4.029.6 **234**

336 Channels for V.H.F.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 150, 154.) Brief description of equipment shown to the Physical Society in 1946. 336 channels were frequency-controlled to ±10 kc/s during transmission and reception by only three crystals, selection being made remotely by means of numbered or lettered dials.

621.396.619.018.41 **235**

A Review of Wide Band Frequency Modulation Technique.—C. E. Tibbs. (*J. Brit. Instn Radio Engrs*, June/Sept. 1944, Vol. 4, No. 2, pp. 85–119. Discussion, pp. 119–129.) The basic theory of frequency modulation is first outlined and the form of the frequency spectrum derived. The improvement in signal/noise ratio resulting from the use of frequency modulation is discussed and illustrated graphically, and the effects of increasing the frequency deviation, the use of pre-emphasis and the suppression of a weaker signal by a stronger one are explained.

It is shown that selective fading during propagation of a frequency-modulated signal can lead to serious distortion and that a system operating over an ionospheric path would therefore be unsatisfactory. Most frequency-modulated systems operate in the v.h.f. band with a stacked dipole or 'turnstile' transmitting aerial array and a simple dipole receiving aerial.

Transmitter features peculiar to this form of modulation are discussed, including the modulator originally designed by Armstrong and one incorporating a reactance valve. Two types of station monitor are described, with a signal generator suitable for test work. The general design of a suitable receiver is given, with details of a typical limiter circuit, double tuned circuits, phase difference discriminators, and a tuning indicator.

A bibliography of 28 items is appended.

621.396.619.16 + 621.396.61.029.64 **236**

Army No. 10 Set.—(*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 282–285.) Description of the u.h.f. sender, a split-anode magnetron with the segments arranged cylindrically about the cathode as axis, the receiver and the aerial system. A miniature triode is used as a local oscillator, with a crystal as the first detector, in the superheterodyne receiver. The aerial system comprises a waveguide matching section connected to a flexible waveguide, with a reflector placed before its open end, brought through the centre of a parabolic mirror. For previous articles on this set see 470 and 2706 of 1946.

621.396.619.16 **237**

Pulse Terminology.—W. A. Beatty : "Cathode Ray". (*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 311–312.) Discussion of the proper terminology for various types of pulse modulation, arising out of 2006 of 1946 ("Cathode Ray").

621.396.619.16 : 621.396.822 **238**

Noise and Pulse Modulation.—T. Roddam. (*Wireless World*, Oct. 1946, Vol. 52, No. 10, pp. 327–329.) Pulse position modulation, with constant amplitude pulses and a constant number of pulses per second, would appear to give a noise-free communication system, since reception depends only on the position of the leading edge of each pulse. Considerations of bandwidth, however, show that this is untrue, and a value for the ratio of bandwidth to highest modulation frequency is obtained for the signal-to-noise ratio to be an improvement over a.m. systems. Examples of typical pulse systems show an improvement of up to 30 db. The effect of impulsive noise is also considered. See also 2006 of 1946 ("Cathode Ray") for basic principles of pulse modulation.

621.396.619.16 : 621.396.97 **239**

Pulse Time Multiplex System tested at New York Demonstration.—(*Telegr. Teleph. Age*, Oct. 1946, Vol. 64, No. 10, pp. 15–18.) Outline description of a system employing pulse-time modulation, with notes on a recent demonstration in which eight programmes of various types (ordinary broadcast, facsimile, teleprinter, recording of music, etc.) were dealt with simultaneously. The pulse repetition frequency for each channel is 24 000 per sec. A width of 9 kc/s is available on each channel for modulation purposes; each channel may carry low definition information (such as high-speed morse) on a number of sub-channels defined by appropriate tone filters. The demonstration was carried out at a frequency of 930 Mc/s (peak power 800 W), omnidirectional and paraboloid type aerials being used respectively at the transmitter and the receiver. See also 3049 of 1946 (Grieg).

621.396.7 **240**

H.M.S. "Boxer".—G. M. Bennett. (*Wireless World*, Oct. 1946, Vol. 52, No. 10, pp. 324–326.) Fitted with equipment designed for fighter direction over sea and shore, this British warship has six high-power radar sets of various ranges with associated interrogators and beacons. Other installations include transmitters and receivers for use in all frequency bands, direction-finding equipment and a W/T homing beacon. Sets can be operated without mutual interference and data are collated in a central control room.

621.396.82 : 621.396.1 **241**

Interference Considerations affecting Channel-Frequency Assignments.—M. Reed & S. H. Moss. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 355–361.) A study is made of the mutual interference problems which arise when a number of stations transmitting c.w. signals and having the same frequency tolerance share a given frequency band. On the assumption that the transmitters are grouped into a number of channels spread over the frequency band, it is shown that, for a given receiver selectivity specified by its gate width, no practical advantage is gained by having a spacing of the channel frequencies less than about 75% of the nominal transmitter tolerance bandwidth, although (except over a limited region when the receiver gate is wider than the transmitter tolerance) a spacing equal to this bandwidth should not be exceeded. For a given separation between channels it is demonstrated that, in general, the interference falls with reduction of the receiver gatewidth.

621.396.97(4) **242**

Broadcasting in Europe.—(*J. Brit. Instn Radio Engrs*, Jan./Feb. & March/May 1946, Vol. 6, Nos. 1 & 2, pp. 33–40 & 41–46.) A summary of discussions held by various sections of the British Institution of Radio Engineers on a plan suggested by the Radio Industry Council in July, 1945, for a complete reallocation of broadcast frequencies throughout Europe (see 3667 of 1945).

621.396.97(058) **243**

"Broadcasting" Year Book, 1946. [Book Review]—Broadcasting Publications Inc., Washington, 580 pp. (*Wireless World*, Oct. 1946, Vol. 52, No. 10, p. 332.) A reference book containing the F.C.C. broadcasting regulations and directories of U.S., Canadian, and S. American stations.

SUBSIDIARY APPARATUS

538.652 : 62 **244**

Magnetostriction in Industry Processes.—Sloane. (*See* 127.)

621–526 **245**

Theory of Servo Systems, with particular reference to Stabilization.—A. L. Whiteley. (*J. Instn elect. Engrs*, Part II, Aug. 1946, Vol. 93, No. 34, pp. 353–367. Discussion, pp. 368–372.) Methods are described for achieving stability in continuous-control servo systems. Stability may be improved by the insertion of passive networks at the input end of the system to give approximations to derivatives and/or integrals of error which may be used to modify the performance characteristics. Feedback methods may often be used similarly. To assist calculations of constants of the added stabilizing networks, standard forms, which have been found to apply to widely different electric servos, are tabulated. A summary of this paper was noted in 2013 of 1946.

621–526 **246**

Dynamic Behavior and Design of Servomechanisms.—G. S. Brown & A. C. Hall. (*Trans. Amer. Soc. mech. Engrs*, July 1946, Vol. 68, No. 5, pp. 503–522. Discussion, pp. 522–524.)

621–526 : 621.313.28 **247**

A New Torque Motor.—A. E. Adams & D. Waloff. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, p. 308.) For servo applications. The normal rotating armature is replaced by gyratory motion of a low-inertia armature so that starting and stopping are almost instantaneous. The gyratory motion is transformed into rotation in the output shaft by a single stage of planetary gearing.

621.314.63 **248**

Metal Rectifier Developments — Possible Applications of Titanium Dioxide.—H. K. Henisch. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 313–315.) The three main problems are: (*a*) producing the conducting material consistently, (*b*) making the semiconductor as a thin film, and (*c*) the nature of the best electrodes.

621.315.21.029.4/.6] : 536.4 **249**

The Power Rating (Thermal) of Radio-Frequency Cables.—R. C. Mildner. (*J. Instn elect. Engrs*, Part I, Sept. 1946, Vol. 93, No. 69, p. 414.) Summary of 3066 of 1946.

621.315.668.2 **250**

Steel Tower Economics.—P. J. Ryle. (*J. Instn elect. Engrs*, Part I, Sept. 1946, Vol. 93, No. 69, pp. 407–409.) Summary of I.E.E. paper. See also 3067 of 1946.

621.316.86 : 546.281.26 **251**

Silicon Carbide Non-Ohmic Resistors.—Ashworth, Needham & Sillars. (*See* 141.)

621.317.755 **252**

A New Oscilloscope with D.C. Amplification.—J. H. Reyner & F. R. Milsom. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 297–299.) A general purpose instrument designed so that (*a*) all frequencies from zero to the megacycle region can be handled, (*b*) the image is sharply defined and completely steady, (*c*) instantaneous positioning at any part of the screen is provided, (*d*) any part of the trace can be expanded, (*e*) the various controls are independent, and (*f*) performance is consistent, and the instrument has long life. Methods of achieving these objectives are explained.

621.318.323.2.042.15 **253**
Permeability of Iron-Dust Cores.—G. W. O. H.: Lamson: Burgess. (*See* 35.)

621.318.4.017.31 : 621.316.974 **254**
Power Loss in Electromagnetic Screens.— Davidson, Looser & Simmonds. (*See* 33.)

621.394.652 : 621.394.141 **255**
A Deluxe Electronic Key.—W. R. De Hart. (*QST*, Sept. 1946, Vol. 30, No. 9, pp. 17–23.) An electronic circuit for automatic keying and monitoring purposes. The apparatus consists of two units: (*a*) a multivibrator which gives an output of dots or dashes depending on the position of an operating key; (*b*) A keying amplifier, monitoring oscillator and loudspeaker. The system has the advantage that no mechanical device is included.

621.396.615.17 **256**
Laboratory Pulse Generator with Variable Time Delay.—D. R. Scheuch & F. P. Cowan. (*Rev. sci. Instrum.*, June 1946, Vol. 17, No. 6, pp. 223–226.) A biased multivibrator ('flip-flop') can be adjusted so that the output pulse occurs at any desired interval between 2 μs and 850 μs after the input. Output pulse width is adjustable between 1 μs and 40 μs. Input signals of arbitrary waveform may be used at frequencies up to 100 kc/s. At 10 kc/s the minimum sine-wave input signal to operate the instrument is 0.2 V. The delayed pulse is delivered at low impedance with maximum amplitude 150 V. Block and circuit diagrams are given and fully explained.

621.396.68 : 621.397.5 **257**
30 kV Power Supply.—H. C. Baumann. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 77–78.) Details of a voltage trebler circuit giving 100 μA at 30 kV. It has a push-pull oscillator at 300 kc/s with a 350-V plate supply, and a r.f. transformer with separate secondaries for the high voltage and the rectifier filaments.

621.396.681 **258**
A Simple Battery Operated High Voltage Supply.—L. E. Williams. (*Rev. sci. Instrum.*, Aug. 1946, Vol. 17, No. 8, pp. 296–297.) The audio frequency from a blocking oscillator is transformed to a high voltage and is rectified by a diode to give an output of more than 1 000 V at 100 μA. The battery supply is 90 V at about 15 mA and a variable resistance in series with this battery adjusts the voltage output. (Appears similar to 3539 of 1940 [Burgess].)

TELEVISION AND PHOTOTELEGRAPHY.

535.241.4 **259**
" Foot-Lambert " Unit of Picture Brightness.—(*See* 67.)

621.385.832.032.2 **260**
Magnetic Focusing and Deflection.—Rawcliffe & Dressel. (*See* 303.)

621.385.832.032.2 **261**
Comparison of Electrostatic and Electromagnetic Deflection in Cathode-Ray Tubes.—(*See* 304.)

621.397.26 **262**
Electronic Newspaper.—(*Gen. elect. Rev.*, Sept. 1946, Vol. 49, No. 9, pp. 49–50.) In a trial next year, four 9½ inch by 12 inch pages of text or photographs will be relayed by f.m. broadcasting stations to facsimile receivers during transmissions lasting 15 minutes. See also 3444 of 1946.

621.397.26 **263**
Method of Transmitting Sound on the Vision Carrier of a Television System.—D. I. Lawson, A. V. Lord & S. R. Kharbanda. (*J. Televis. Soc.*, June 1946, Vol. 4, No. 10, pp. 239–250.) See 3091 of 1946 and back references.

621.397.26 **264**
A Method of Transmitting Sound on the Vision Carrier of a Television System.—D. I. Lawson, A. V. Lord & S. R. Kharbanda. (*J. Instn elect. Engrs*, Part I, Sept. 1946, Vol. 93, No. 69, pp. 415–416.) Summary of 3091 of 1946.

621.397.4 : 621.394.64.029.64 **265**
Facsimile over 4 000-Mc/s Relay System.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 146, 150.) An experimental two-way radio relay system, with repeater stations, has been used for transmitting various types of intelligence including facsimile transmission of text and photographs using a 4.8 kc/s bandwidth.

621.397.5 **266**
System Standards.—(*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 72–73.) Reference data and standards currently in use for the information and guidance of television design engineers.

621.397.5 : 621.317.2 **267**
A Television Pattern Test Generator.—F. A. Inskip. (*J. Televis. Soc.*, June 1946, Vol. 4, No. 10, pp. 255–256. Discussion, p. 257.) The unit is portable and is modulated to give a simple pattern on a c.r. tube screen. The tuning range is 30–60 Mc/s with calibration points at 45 and 41.5 Mc/s so that the sound section of the receiver can also be checked. A circuit diagram is given, and the procedure for testing receivers and sound explained.

621.397.5 : 621.317.2 **268**
TV [television] **Test Equipment.**—P. H. Hunter. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 49–51 . . 108.) There is a particularly urgent demand for a " . . . synthetic video pattern generator capable of producing various types of test patterns on television receiver screens for the evaluation of their over-all performance ". Design trends are discussed, and existing equipment reviewed.

621.397.5 : 621.396.677 **269**
Rhombic Antennas for Television.—Minter. (*See* 26.)

621.397.5(44) **270**
Television in France.—(*J. Televis. Soc.*, March 1946, Vol. 4, No. 9, pp. 224–225.) An abstract of a report by the Combined Intelligence Objectives Sub-Committee, which describes visits to the Compagnie des Compteurs, Montrouge, and to the studios of the R.D.F. At the former a 400-line projection on a screen 6 ft by 4 ft was seen, the quality being comparable with that from Alexandra Palace. Iconoscopes were employed for all cameras:

owing to the shortage of mica the mosaic was deposited on oxidized aluminium sheet. Demonstrations of both a 1050- and a 450-line system were seen, the increase in entertainment value with the 1050-line system being most marked. Electrostatic lenses were used in all the iconoscopes, but magnetic lenses were used in the projection tubes.

The transmitter in the Eiffel Tower belonging to 'R.D.F.' was damaged by the Germans before they left, and will probably not be in operation for two years. 'R.D.F.' has a large television studio built to the order of the Germans and in which all the equipment is German and made by Fernseh A.G. Demonstrations of film transmission with a 441-line interlaced system gave very good definition and a quality comparable with film transmission from Alexandra Palace. Three additional studios were under construction. See also 2741 and 1105 of 1946.

621.397.621 **271**

Line Scanning Systems for Television.—A. M. Spooner & E. E. Shelton. (*Electronic Engng*, Oct. 1946, Vol. 18, No. 224, pp. 302–307.) Formulae are derived for the time-base wattage of electrostatic and electromagnetic deflecting systems. A 'figure of merit' is obtained for deflecting coils, and its experimental measurement considered. The importance of each variable involved, such as illumination, anode voltage, beam current, and tube shape, is considered, and the relative merits of various scanning coils deduced.

621.397.621 : 621.397.645 **272**

Electromagnetic Frame Scanning.—W. T. Cocking. (*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 289–291.) A linear frame-scan can be obtained economically only by compensating for the non-linearity of the coupling to the scan coils by the valve curvature. See also 3080 of 1946 (Cocking).

621.397.645 **273**

Video Amplifier H.F. Response : Parts 1 & 2.—(*See* 61 & 62.)

621.397.823 **274**

The Noise Suppressor in the V114 [television set].—H. A. Fairhurst. (*Murphy News*, Oct. 1946, Vol. 21, No. 10, pp. 244–246.) Suppression for noise pulses shorter than the periodic time of the highest audio frequency is obtained by a series diode in which a backing potential is derived from the audio signal through a circuit of time constant less than that corresponding to the maximum audio frequency but greater than the noise pulse duration.

TRANSMISSION

621.396.13 : 621.394.65 **275**

Frequency Shift Keying Techniques.—C. Buff. (*Radio, N.Y.*, Aug. 1946, Vol. 30, No. 8, pp. 14 . . 30.) The change in bias of a reactance tube, connected across the tuned circuit of a 200 kc/s oscillator, produces the desired frequency shift. The gain in signal-to-noise ratio is experimentally estimated as 11 to 20 db better than for on-off keying. Circuit and design data are included. See also 2306 of 1946 (Peterson *et al.*).

621.396.61 **276**

A Medium-Power Bandswitching Transmitter.—R. M. Smith. (*QST*, Oct. 1946, Vol. 30, No. 10, pp. 13–21 . . 108.) A crystal oscillator, arranged for five alternative crystals, is connected directly to a type 807 amplifier on the 80- and 40-metre amateur bands or through a type 6N7 frequency multiplier into the 807 amplifier on the 20- and 10-metre bands. The final amplifier uses a type 4-125A beam tetrode with an input of 375 W for c.w. or 270 W for telephonic operation.

621.396.619.018.41 : 621.385.5 **277**

Phasitron F.M. Transmitter.—F. M. Bailey & H. P. Thomas. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 108–112.) Describes in detail the mode of operation of the phasitron (see also 1405 and 2767 of 1946) and its application to a 250-W transmitter covering the frequency range 88–108 Mc/s. The phasitron output frequency is multiplied by 432 to give carrier frequency. Inductive tuning is employed in the output tank circuit of the transmitter, the entire frequency range being covered without changing coils or taps.

VALVES AND THERMIONICS

519.2 **278**

The Resultant of a Large Number of Events of Random Phase.—C. Domb. (*Proc. Camb. phil. Soc.*, Oct. 1946, Vol. 42, Part 3, pp. 245–249.) " Rayleigh's method of deducing the probability distribution of the amplitude of the sum of n equal vibrations of random phase is generalized to the case when the amplitude of each vibration is a definite function of its phase. The same method is applied to the shot effect and it enables the distribution of random noise to be obtained. Campbell's theorem and its generalizations can then be deduced from this."

537.291 **279**

Influence of Space Charge on the Bunching of Electron Beams.—Brillouin. (*See* 75.)

537.533.8 : 621.385.1.032.216 **280**

Dissociation Energies of Surface Films of Various Oxides as determined by Emission Measurements of Oxide Coated Cathodes.—H. Jacobs. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 692–693.) Summary of Amer. Phys. Soc. paper.

537.533.8 : 621.385.1.032.216 **281**

Enhanced Thermionic Emission from Oxide Cathodes.—J. B. Johnson. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 702.) After bombardment by a short pulse of electrons, the thermionic activity of a cathode in the temperature range for emission can remain abnormally high for many microseconds. Summary of Amer. Phys. Soc. paper.

537.533.8 : 621.385.1.032.216 **282**

Secondary Emission of Thermionic Oxide Cathodes.—J. B. Johnson. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 693.) The number, δ, of secondary electrons emitted per primary, rises with primary energy from 1 at about 30 eV to a maximum of 4–10 at 1 200–1 500 eV. When cold the oxide has a higher δ but acquires a surface charge which limits the escape of secondaries. δ decreases with increased temperature and the reported exponential increase with temperature (see 1925 of 1939, Morgulis & Nagorsky) is attributed to a temporary increase in thermionic activity. Summary of Amer. Phys. Soc. paper.

537.533.8 : 621.385.1.032.216 **283**

The Poisoning of Oxide Cathodes by Gold.—J. Rothstein. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 693.) The experimental technique is described. It is concluded that "Au readily migrates (diffuses) over (BaSrCa)O and Ni, that Au inhibits emission, and that suitable thermal gradients can alter Au concentration and restore emission. It seems likely that Au exerts its maximum inhibiting effect when present at the outer surface of the oxide." Summary of Amer. Phys. Soc. paper.

537.533.8 : 621.385.1.032.216 **284**

Dissociation Energies of Surface Films of Various Oxides as determined by Emission Measurements of Oxide Coated Cathodes.—H. Jacobs. (*J. appl. Phys.*, July 1946, Vol. 17, No. 7, pp. 596–603.) When an electron achieves a critical kinetic energy in moving from cathode to an oxide-coated anode, a dissociation of the oxide results. Liberated oxygen returning to the cathode reduces emission. This critical energy was found to be equivalent to the heats of formation of the oxides bombarded.

621.314.632 **285**

Small Deviations from Diode Behavior in Crystal Rectification.—K. F. Herzfeld. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 683.) Assuming that the mean free path of the electrons in the blocking layer is large, but not infinite, compared with the thickness of the layer, it is found that the dependence of current on voltage is slightly less than in the pure diode theory. Summary of Amer. Phys. Soc. paper.

621.326[.1 + .3/.4] : 621.392.5 : 621.316.722.078.3 **286**

The Characteristics of Lamps as applied to the Non-Linear Bridge, used as the Indicator in Voltage Stabilizers.—Patchett. (*See* 45.)

621.384.5.08 **287**

The Properties of Glow Tubes and Their Applications for Measurement Purposes.—Glaser. (*See* 191.)

621.38.216 **288**

A High Power Rising Sun Magnetron.—A. Ashkin. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 701.) A mode separation of a rising sun magnetron is independent of anode length. Tubes with long anodes have been constructed to give a peak power of 1 MW for λ 3 cm with output efficiency of about 45%. Summary of Amer. Phys. Soc. paper.

621.385.16 **289**

"Crown of Thorns" Tuning of Magnetrons.—S. Sonkin. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 701.) Description of a mechanically tunable vane-type magnetron for which linear tuning up to 10% was obtained. The causes and elimination of variations in power output with wavelength are discussed. Summary of Amer. Phys. Soc. paper.

621.385.16 **290**

Space-Charge Frequency Dependence of a Magnetron Cavity.—M. Phillips & W. E. Lamb, Jr. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 701.) A correction to the resonant frequency due to a thin layer of space charge surrounding the cathode is given "by a resonance type formula about the cyclotron frequency $eB/2\pi m$". A small amplitude theory is used based on a single stream steady state, and is limited to low level oscillations. Summary of Amer. Phys. Soc. paper.

621.385.16 **291**

Energy Build-Up in Magnetrons.—L. P. Hunter. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 700.) Analysis of the law of build-up and its dependence on load, initial noise level and cavity *Q*. Summary of Amer. Phys. Soc. paper.

621.385.16 **292**

One Centimeter Rising Sun Magnetrons with 26 and 38 Cavities.—A. V. Hollenberg, S. Millman & N. Kroll. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 701.) Summary of Amer. Phys. Soc. paper.

621.385.16 : 621.396.615.14.029.63/.64 **293**

The Magnetron as a Generator of Centimeter Waves : Parts 1 & 2.—J. B. Fisk, H. D. Hagstrum & P. L. Hartman. (*Bell Syst. tech. J.*, April 1946, Vol. 25, No. 2, pp. 167–263 & 264–348.) In Part 1 the fundamentals of the magnetron are discussed. A general picture is given of the nature of the electronic mechanism, and of the role played by the r.f. circuit and load. The second part gives a description of tests on a British 10-cm, 10-kW, 8-resonator magnetron which led to the development of radar magnetrons for λ 20 to 45 cm with peak power up to 700 kW ; the introduction of strapping improved efficiency greatly at the higher powers. Tunable magnetrons were first investigated at this wavelength, but later also for λ 3 cm. Variations of the British design resulted in a series of magnetrons with powers up to 1 MW for λ 10 cm. Then came magnetrons with λ 3 cm for airborne and marine applications, while finally for λ 1 cm the 3J21 'rising sun' magnetron was developed.

Details of design, production problems, and general performance of all these magnetrons are given, together with a short account of work on cathode design.

621.385.16.029.63 **294**

New Magnetron Designs for Continuous Operation in the Decimeter Wave Range.—D. A. Wilbur. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 118.) Two devices to eliminate cathode back heating from high-frequency operation of the split-anode magnetron are described, in which multi-gap operation is attained together with an easily tunable external tank circuit. (1) Only two segments of the multi-gap are used, the remainder being replaced by a single electrode maintained at zero r.f. potential. (2) A multiplicity of electrodes is used mounted internally on a conducting helix.

Abstract of an Amer. Phys. Soc. paper.

621.385.16.032.21.029.63 **295**

A 10-Kilowatt Magnetron with Water-Cooled Cathode.—R. V. Langmuir & R. B. Nelson. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 118.) A simple split-anode magnetron delivering over 10 kW c.w. at 60% efficiency and tuning from 560 to 625 Mc/s was developed for radar jamming. The efficiency is comparable with that of multiple-anode types. The cathode operates by secondary emission, and is water-cooled ; the best secondary-emission surface found was made of a magnesium alloy.

Abstract of an Amer. Phys. Soc. paper.

621.385.16.032.22 **296**

Development of the Rising Sun Magnetron Anode Structure.—S. Millman & A. Nordsieck. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 701.) With very short waves the mode separation of magnetrons by strapping becomes difficult and expensive. An alternative method is to make the resonator cavities alternately large and small with resonant wavelength ratio between 1.5 and 2.5. The mode spectrum, and the advantages and limitations of these magnetrons are discussed. Summary of Amer. Phys. Soc. paper.

621.385.16.032.22 **297**

Theory of the Rising Sun Magnetron Anode.—N. Kroll & W. E. Lamb, Jr. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 701.) The method is analogous to that of Clogston for a symmetric anode. Maxwell's equations can be solved for both the cathode-anode space and the side resonators for a specified boundary tangential electric field. Resonance is determined by the continuity of the average magnetic field at the junctions. The method may be extended to other structures. Summary of Amer. Phys. Soc. paper.

621.385.18.029.64 : 537.5 **298**

Conductivity of Electrons in a Gas at Microwave Frequencies.—Margenau. (*See* 76.)

621.385.831.012.8 **299**

Equivalent Noise Representation of Multi-Grid Amplifier Tubes.—Twiss & Schremp. (*See* 37.)

621.385.832 + 621.397.331.2 **300**

Simplification of Cathode Ray Tube Design by the Application of the Theory of Similitude.—H. Moss. (*J. Televis. Soc.*, March 1946, Vol. 4, No. 9, pp. 206–219. Discussion, p. 228.) A discussion of "the application of the general theories of scale, dimensional homogeneity, and energy conservation to cathode-ray tube designing. From these simple bases it is shown that many important deductions can be drawn about the general form which the tube geometry should assume."

The following four rules form the basis of the 'relaxation' methods of cathode-ray-tube design. The first three are quite rigorous within their limiting postulates. The fourth has some theoretical justification, but the main support is experimental.

(1) Principle of voltage similitude: in any electron optical system, in which space charge is negligible, and in which the electrons start from rest, the electron trajectory is unaltered by multiplication of all electrode potentials by a constant factor k. The transit time between any two fixed points in the system varies as $1/\sqrt{k}$.

(2) Principle of geometrical similitude: in any electron optical system in which the total current flow is constant, the shape of the field and of the electron trajectory is unaltered by multiplication of the size of all the bounding electrodes by a constant factor k. The transit time between corresponding points in the two systems is proportional to k.

(3) Spot size/crossover size relationship: if the crossover and spot are formed in regions of the same potential, then spot size = crossover size × geometrical magnification (M). More generally, if V_1 is the crossover potential, and V_2 the spot potential, then spot size = crossover size × M × $\sqrt{V_1}/\sqrt{V_2}$.

(4) Dependence of crossover size on voltage on crossover forming electrode: to a close approximation, in any system where the space charge is negligible, the crossover diameter is inversely proportional to the square root of the potential on the crossover-forming electrode.

Proofs of these principles are given, and they are applied to some specific problems including the design of projection tubes.

621.385.832 : 535.371.07 **301**

Long Persistence C.R. Tube Screens.—Feldt. (*See* 123.)

621.385.832 : 621.396.9 **302**

Skiatron.—(*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 216..220.) A short account of a lecture by P. G. R. King at the I.E.E. Radiolocation Convention, already noted in 2404 of 1946.

621.385.832.032.2 **303**

Magnetic Focusing and Deflection.—D. Rawcliffe & R. W. Dressel. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 52–56..111.) Magnets have the advantages of light weight and stability with respect to temperature, but generally give a focus inferior to that obtained with coils. Air-core and iron-core deflection coils are designed to overcome the distortion in a display pattern due to the curvature of the tube screen, non-uniformity of the magnetic field and inductive and capacitive coupling between the various points of the coils.

621.385.832.032.2 **304**

Comparison of Electrostatic and Electromagnetic Deflection in Cathode-Ray Tubes.—(*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, p. 364.) Summary of I.E.E. Radio Section discussion led by E. W. Bull and V. A. Stanley. It was pointed out that defocusing with beam deflexion was greater with electrostatic deflexion because the electron beam underwent energy changes in the deflecting field. Electrostatic tubes suffered from trapezium distortion. The effects of gaseous ions were less with electrostatic deflexion. Less energy was required to scan an electrostatic tube.

The use of mixed magnetic and electrostatic deflection, the difficulties of aligning deflexion and focusing coils when replacing magnetic tubes and the question of deflexion methods for oscillograph purposes were also discussed. For another account see *J. Televis. Soc.*, June 1946, Vol. 4, No. 10, p. 264.

621.396.622 : 621.396.619.018.41 **305**

Single-Stage F. M. Detector.—Bradley. (*See* 227.)

621.385 (02) **306**

Inside the Vacuum Tube. [Book Review]—J. F. Rider. J. F. Rider Publisher Inc., New York, $4.50. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1946, Vol. 7, No. 9, p. 37.) "The aim in his [the author's] numerous well-known works has been to cover one subject at a time, dealing mainly with fundamentals and starting from ground level."

MISCELLANEOUS

001.891 **307**

Research Problems of the Smaller Firm.—(*Electrician*, 25th Oct. 1946, Vol. 137, No. 3569, p. 1140.) Brief summary of address by Sir Edward Appleton.

002 : 001.81 **308**

The Preparation of Technical Papers.—W. E. Clegg. (*J. Instn Engrs Aust.*, June 1946, Vol. 18, No. 6, pp. 135–139.) Paper presented before the Juniors' and Students' Section of Newcastle division. A bibliography of 11 items is given.

061.6 **309**

The National Physical Laboratory at Teddington.—(*Nature, Lond.*, 14th Sept. 1946, Vol. 158, No. 4011, pp. 361–363.) A review of its work as seen on the first post-war open day.

614.825 **310**

Dangerous Electric Currents.—C. F. Dalziel. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 579–584.) A general account of the physiological effects, and the factors determining their magnitude, of the passage of electric currents through the body. Illustrative results of particular tests applied to certain animals and to man are included.

620.197 (213) : 621.396.6.045 **311**

Tropicalizing [transformers and chokes]**.**—Scarff. (*See* 133.)

620.197 (213) : 621.314.045 **312**

Impregnated Windings [for "tropicalizing" transformers]**.**—Williams : Burkett. (*See* 134.)

621.3(091) : 51 **313**

Notable Electrotechnical Forecasts.—C. Grover. (*Distrib. Elect.*, Oct. 1946, Vol. 19, No. 164, pp. 180–182.) An historical review of the contribution of mathematics to the development of electrical theory and forecasting of phenomena.

621.39 : 371.3] + 621.315.6 **314**

I.E.E. Radio Section Address : Part 1 — Training Courses ; Part 2 — Dielectric Developments.—W. Jackson. (*Elect. Rev., Lond.*, 18th Oct. 1946, Vol. 139, No. 3595, p. 609 ; *Electrician*, 18th Oct. 1946, Vol. 137, No. 3568, pp. 1065–1066.) Summaries of Chairman's inaugural address.

621.317 **315**

The History and Development of the British Scientific Instrument Industry.—S. L. Barron. (*Beama J.*, Sept. 1946, Vol. 53, No. 111, pp. 325–328.) Abridged version of a lecture delivered at the Stockholm Exhibition of British Scientific Instruments, 1946.

621.317.785 **316**

Trends in Measurements.—L. J. Matthews. (*Elect. Times*, 31st Oct. 1946, Vol. 110, No. 2871, p. 603.) Summary of inaugural address of the Chairman to the I.E.E. Measurements Section dealing particularly with recent developments in consumers' a.c. meters.

621.327.43 : 628.971.6 **317**

Dimming Fluorescent Lighting.—H. A. Miller. (*Elect. Rev., Lond.*, 20th Sept. 1946, Vol. 139, No. 3591, pp. 457–458.) The possible circuits discussed are (*a*) series resistance, (*b*) variable-voltage auto-transformer, (*c*) saturable reactor control, (*d*) thyratron control. Diagrams are given for each.

621.38.001.8 **318**

Electronics — Servant or Fad ?—P. G. Weiller. (*Instruments*, Jan. 1946, Vol. 19, No. 1, pp. 2–8.) Verbatim account of a lecture in which the advantages and disadvantages of electronic control and measuring devices for industrial applications are discussed. It is stressed that very careful prior consideration is necessary to decide whether such a device is likely to provide a practicable and economic solution to the problem in hand. Several instructive examples are described.

621.396 : 371.3 **319**

Aids to [radio] **Training.**—M. G. Scroggie. (*Wireless World*, Sept. 1946, Vol. 52, No. 9, pp. 303–304.) A review of an exhibition of equipment used in the teaching and training of R.A.F. personnel in the operation and maintenance of radio and radar apparatus.

654.19(41) **320**

Broadcasting in Great Britain.—(*Nature, Lond.*, 31st Aug. 1946, Vol. 158, No. 4009, pp. 314–315.) Abstract of the White Paper on Broadcasting policy which justifies the renewal of the B.B.C.'s Royal Charter for 5 years from 1st January, 1947.

530.145(02) **321**

Philosophic Foundations of Quantum Mechanics. [Book Review] —H. Reichenbach. University of California Press, Berkeley & Los Angeles : Cambridge University Press, London, 1944, 182 pp., $3. (*Nature, Lond.*, 14th Sept. 1946, Vol. 158, No. 4011, pp. 356–357.)

621.3(031) **322**

Whittaker's Electrical Engineer's Pocket Book. [Book Review] — R. E. Neale (Ed.). Pitman, London, 7th edn 1946, 938 pp., 30s. (*Electrician*, 12th July 1946, Vol. 137, No. 3554, p. 100 ; *Wireless World*, Oct. 1946, Vol. 52, No. 10, p. 332.) New edition, almost completely rewritten to bring it into line with modern practice.

621.394/.395](021) **323**

A Handbook of Telecommunication (Telephony & Telegraphy over Wires). [Book Review] —B. Cohen. Pitman, London, 437 pp., 30s. (*Elect. Rev., Lond.*, 25th Oct. 1946, Vol. 139, No. 3596, p. 652.)

621.396(075) **324**

An Experimental Course in the Fundamental Principles of Radio. [Book Review] —R. H. Humphrey. Pitman, London, 194 pp., 12s. 6d. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, p. 292.)

621.396(075) **325**

Radio Communications. [Book Review] —W. T. Perkins & R. W. Barton. George Newnes, London, 312 pp., 12s. 6d. (*Elect. Rev., Lond.*, 23rd Aug. 1946, Vol. 139, No. 3587, p. 296; *Wireless World*, Sept. 1946, Vol. 52, No. 9, p. 307.) ". . . primarily a manual of the 'question and answer' type, intended for students. . . ."

621.396.3(075) **326**

Handbook of Technical Instruction for Wireless Telegraphists. [Book Review] —H. M. Dowsett & L. E. Q. Walker. Iliffe & Sons, London, 8th edn, 660 pp., 30s. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 292–293.) ". . . It is an essential requirement for passing the P.M.G. Certificate and can be confidently recommended to all prospective wireless telegraphists."

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534 **327**

Problems of Modern Acoustics: Noise and Vibration.—P. Chavasse. (*Onde élect.*, July 1946, Vol. 26, No. 232, pp. 274–287.) A review of the subject covering architectural, physiological and musical acoustics, electroacoustics and supersonics. The definition of intensity in accordance with the Weber-Fechner law leads to the units decibel, phon, son, pal and vibro based on the frequency curves of equal aural or tactile sensation. Apparatus which gives an objective indication of sound level has been constructed using microphones and an amplifier with a frequency weighting circuit corresponding to the response of the ear.

534.212 : 534.321.9 **328**

The Directional Characteristics [for supersonic radiation] **of a Free-Edge Disk mounted in a Flat Baffle or in a Parabolic Horn.**—F. H. Slaymaker, W. F. Meeker & L. L. Merrill. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 355–370.) Full paper, summary of which was noted in 3512 of 1946.

534.231 **329**

Ray Computation for Non-Uniform Fields.—J. S. Saby & W. L. Nyborg. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 316–322.) A formula is derived which simplifies computation and ray tracing. The method is particularly useful in the study of the propagation of supersonic waves in the atmosphere.

534.24 : 551.510.52 **330**

Reflection of Sound Signals in the Troposphere.—G. W. Gilman, H. B. Coxhead & F. H. Willis. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 274–283.) Attempts have been made to detect non-homogeneities in the first few hundred feet of the atmosphere by vertical propagation of sound waves with a low-power set which has been named the sodar. Periods of strong temperature inversion, strong sodar displays and strong microwave fading tended to coincide, but it is significant that sound echoes were often very strong when there was no meteorological reason to expect them. The sodar seems to have confirmed the existence of non-homogeneities which it would be difficult or impossible to observe by conventional methods.

534.321.9 : 621.395.613.5 **331**

An Ultrasonic Condenser Microphone.—T. H. Bonn. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 496–502.) The microphone has overall diameter 0.875 inch, special electrode design, and essentially constant free field calibration of 51 db below 1 V per dyne per sq. cm up to 32 kc/s.

534.322.1 **332**

Analyses of the Tones of a Few Wind Instruments.—F. A. Saunders. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 395–401.) Charts are given for clarinet, oboe, English horn, French horn, and flute, covering the whole range of each instrument.

534.612 : 621.396.611.21 **333**

A New Sound Measurement System.—F. Massa. (*Communications*, Oct. 1946, Vol. 26, No. 10, pp. 16–17 . . 50.) Determines the absolute magnitude of sound pressures with a minimum of disturbance to free-field conditions or conditions inside small enclosures, by means of a new design of calibrated piezoelectric sub-standard microphone.

534.612.4 + 621.395.613.5] : 551.547 **334**

On the Absolute Pressure Calibration of Condenser Microphones by the Reciprocity Method.—A. L. DiMattia & F. M. Wiener. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 341–344.) Calibration details are given for temperatures from −25°C to +40°C and pressures corresponding to altitudes up to 40 000 ft. The estimated accuracy is ± 0.2 db.

534.78 **335**

On the Intelligibility of Bands of Speech in Noise.—J. P. Egan & F. M. Wiener. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 435–441.) Tests were conducted with several communication systems of different bandwidth, under different conditions of masking noise, and the acoustic gain of the system expressed relative to the transmission of speech through 1 m of air. For each system a relation between syllable articulation and level of received speech was obtained.

534.78 **336**

Speech Clippers for More Effective Modulation.—J. W. Smith & N. H. Hale. (*Communications*, Oct. 1946, Vol. 26, No. 10, pp. 20–22..25.) Peak-limiting methods in transmitters give high average modulation, and improve intelligibility when static interferes with reception or frequency channels are congested. The advantages rise in proportion to the interference. The method also prevents over-modulation and, with a filter, provides a clean, sharp signal with no splatter. The carrier is fully used.

534.78 **337**

The Masking of Speech by Sine Waves, Square Waves, and Regular and Modulated Pulses.—S. S. Stevens, J. Miller & I. Truscott. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 418–424.) Optimum masking is produced when the fundamental frequency of the interfering signal lies in the range 100–500 c/s, the exact position depending on its other characteristics.

Full paper, summary of which was noted in 3527 of 1946.

534.78 : 621.396.813 **338**

Effects of Amplitude Distortion upon the Intelligibility of Speech.—J. C. R. Licklider. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 429–434.) The reduction in intelligibility depends on the type of distortion, but with peak clipping (symmetrical and asymmetrical) the reduction is almost zero. Appreciable centre clipping or linear rectification has a serious effect. Tests under aircraft noise conditions are described, and the improvement in radio communication provided by the noise limiting action of an audio clipping circuit is discussed. Full paper, summary of which was noted in 3524 of 1946.

534.781 : 371.3 **339**

Training for Voice Communication.—J. W. Black & H. M. Mason. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 441–445.) Speech training programme for telephone or radio communication in the U.S. Army Air Force.

534.833.082.4 **340**

The Measurement of Acoustic Absorption by the Stationary Wave Method.—G. Sacerdote. (*Alta Frequenza*, June 1946, Vol. 15, No. 2, pp. 68–76. With English, French and German summaries.) A theoretical analysis.

534.833.1 **341**

Absorption of Sound by Coated Porous Rubber Wallcovering Layers.—C. W. Kosten. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 457–471.)

534.843 **342**

The Effect of Non-Uniform Wall Distributions of Absorbing Material on the Acoustics of Rooms.—H. Feshbach & C. M. Harris. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 472–487.)

534.846.3 **343**

Acoustical Correction by Sound Diffusion.—F. L. Bishop. (*Communications*, Oct. 1946, Vol. 26, No. 10, pp. 36–37.) Hemispherical sound diffusers 12 inches to 36 inches in diameter were arranged in random pattern on one wall of a studio to improve its acoustical properties.

534.862 **344**

A Simplified Recording Transmission System [to operate from a microphone and into a sound recording modulator].—F. L. Hopper & R. C. Moody. (*J. Soc. Mot. Pict. Engrs*, Aug. 1946, Vol. 47, No. 2, pp. 132–141.) Requirements were: light weight, parts easily accessible, high reliability, and low power consumption. The instrument described has a transmission system (whose output is limited by a discharge tube), an amplifier and a noise reduction system. Several components are marked with normal operating voltages for ease in detecting faults. Circuit diagrams are given of the amplifier and power supply unit, together with noise reduction performance graphs.

621.395.61 : 621.385.82.029.3 **345**

[The development of] **a High Power Thermionic Cell using Positive Ion Emission and operating in a Gaseous Medium.**—Klein. (*See* 593.)

621.395.613 : 621.385 **346**

"Vibrotron" Tube.—R.C.A. (*See* 584.)

621.395.623.6 **347**

Development of Midget Earphones for Military Use.—H. A. Pearson, A. B. Mundel, R. W. Carlisle, W. F. Knauert & M. E. Zaret. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 348–354.) Full paper, summary of which was noted in 3534 of 1946.

621.395.625.2 **348**

Lateral Disc Recording at the Naval Research Laboratory.—A. T. Campbell. (*Communications*, Sept. 1946, Vol. 26, No. 9, pp. 11–15..50.) Description of N.R.L. sound recording system facilities, of the types of record produced, and of modifications to commercial equipment used in the system. Response curves over the frequency range 50–10 000 c/s illustrate the performance of different types of pickup. Further improvements are expected from the use of a newly designed moving-coil pickup of which brief details are given.

621.396.33.029.3.083.7 : 656.2 **349**

Train Position Indicator.—Dahl. (*See* 535.)

621.396.645.029.3 **350**

Modern Studio and Portable Speech Input Equipment.—L. G. Killian, P. L. Tourney & J. W. Hooper. (*Radio, N.Y.*, Sept. 1946, Vol. 30, No. 9, pp. 14–17..31.) Technical details for a studio console and a three-channel remote amplifier.

AERIALS AND TRANSMISSION LINES

621.315.211.2 : 679.5 **351**

Developments in Solid Dielectric R.F. Transmission Lines.—R. C. Graham. (*Radio News*, Oct. 1946, Vol. 36, No. 4, pp. 46–48..157.) A brief account of the use of polythene in various types of h.f. cable.

621.315.211.9.052.63 : 621.396.44 **352**

Carrier-Current Communication on Air and Paper Insulated Cables.—F. Lucantonio. (*Alta Frequenza*, June 1946, Vol. 15, No. 2, pp. 77–110. With English, French, and German summaries.) An appreciation of the future importance of this system, using pair and quad lines, for long distance communication, and a discussion of the primary and derived characteristics — impedance, attenuation, cross-talk, and distortion, with numerical data.

621.392 **353**

Wave Guides.—M. H. L. Pryce. (*J. Instn elect. Engrs*, Part I, Oct. 1946, Vol. 93, No. 70, pp. 459–460 [summary] & Part IIIA, 1946, Vol. 93, No. 1, pp. 33–39 [full version].) The early development of waveguides is surveyed. Only when 10-cm waves were developed was the size of waveguides sufficiently convenient to encourage their development. Early guides had high losses. Waveguides became more important when 100-kW magnetrons were developed, as they have low attenuation and are less liable to breakdown by sparking than concentric feeders. It is undesirable that a waveguide should propagate more than one mode, so that a rectangular guide with one side above the critical dimension for the H_{10} mode ($\lambda_0/2$) but less than the critical dimension for the H_{20} mode (λ_0), and the other side below the critical dimension for the H_{01} mode ($\lambda_0/2$) is preferred. The waveguide must be matched to the media or units which precede and follow it. The use of waveguides involves a number of auxiliary components such as couplings, bends, corners, branches, switches, rotating joints, etc., whose design involves specialized techniques.

621.392 : 621.396.11 **354**

Some Questions connected with the Excitation and Propagation of Electromagnetic Waves in Tubes.—Mandelstam. (*See* 506.)

621.392 : 621.396.67 **355**

Dielectric [rod and tubular] **Aerials.**—(*Onde élect.*, Oct. 1946, Vol. 26, No. 235, pp. 387–390.) A review of unpublished German work mainly of an empirical nature by Zinke and Mallach. The polar diagrams of both rod and tubular type aerials are considered in relation to the aerial dimensions and permittivity of the material concerned. For tubes maximum values of 6λ and 0.8λ are suggested for the length and diameter respectively; the upper limit to the wall thickness is set by the need for adequate side- and back-lobe suppression. Similar considerations result in an optimum range for the diameter of a rod aerial. An example of a tapered rod aerial is briefly discussed. Finally it is suggested that a given dielectric aerial will behave satisfactorily over a frequency range of approximately 2 : 1.

621.396.67 : 537.122 : 538.3 **356**

Complete Calculation of the Radiation of a Linear Sinusoidal Oscillator.—É. Durand. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1946, Vol. 222, No. 1, pp. 68–70.) From formulae developed previously (see 392 & 393 below) it is shown that in the radiation field of an electric charge oscillating sinusoidally along a straight line, all the harmonics of the fundamental frequency are present, the amplitudes involving Bessel functions. Potential formulae are derived from which the fields can be easily deduced. With two oscillating charges of opposite sign always occupying symmetrical positions with respect to the origin, only the odd harmonics are found.

621.396.67 : 621.315.62 **357**

Dipole Reflector Insulation.—J. A. Saxton & L. H. Ford. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 325–327.) "The effects of various insulators, used to support the ends of the parasitic aerial, were determined by measurements of the front-to-back signal ratio of a receiving-aerial system consisting of a half-wavelength dipole and a single parasitic reflector, at a wavelength of six metres. The particular insulators used in this investigation resulted in the effective length of the reflector being increased by about 20 per cent."

621.396.67 : 621.396.9 **358**

Aerials for Radar Equipment.—J. A. Ratcliffe. (*J. Instn elect. Engrs*, Part I, Oct. 1946, Vol. 93, No. 70, pp. 458–459 [summary] and Part IIIA, 1946, Vol. 93, No. 1, pp. 22–33 [full version].) For flood-lighting at wavelengths greater than about 3 m, an elevated horizontal dipole was usually used as a transmitter, and an elevated crossed pair of dipoles as receiver. Bearing was obtained by comparing the e.m.fs in the two receiving dipoles with a rotating goniometer coil. Elevation was determined by comparing signals in aerials at different heights. Broadside arrays with arrangements for swinging the beam rapidly by electrical means from side to side were also used to determine bearing. The satisfactory use of a common aerial for transmission and reception was one of the major achievements in radar development. An important and fundamental theorem shows that the space distribution diagram of an aerial is given by the Fourier analysis of the distribution of radiating sources over the aerial. At centimetre wavelengths, pencil beams narrow in elevation and azimuth, or fan beams narrow in one plane only (usually azimuth) become possible. Fan beams rotated about a vertical axis were extensively used for searching.

Pencil beams have usually been produced by a small radiating source situated near the focus of a parabolic mirror, with reflector and/or director elements to ensure that radiation from the source is predominantly towards the mirror.

Fan-shaped beams were produced by distorting a parabolic mirror in one section; a method originated by Chu is available for calculating the mirror shape for any required secondary-radiation pattern. Fan-shaped beams could also be produced by combining a long linear array with a specially shaped cylindrical mirror. The linear array provided a broadside of aerials which must be fed in phase. For this purpose they were coupled to a waveguide and spaced one guide-wavelength apart. A second set of aerials was placed at points midway between the first set and fed in the opposite phase to strengthen the required beam at the expense of an unwanted side-beam. A slight adjustment of position is also required to avoid a highly frequency-sensitive effect due to reflections at coupling points.

621.392 **359**

Wave Guides. [Book Review]—H. R. L. Lamont. Methuen, London, 2nd edn 1946, 96 pp., 6s. 3d (in Australia). (*Proc. Instn Radio Engrs, Aust.*, Oct. 1946, Vol. 7, No. 10, p. 31.)

CIRCUITS AND CIRCUIT ELEMENTS

621.314.6 **360**

Nonlinear Commutating Reactors for Rectifiers.—A. Schmidt, Jr. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 654–656.) A commutating reactor is used to 'drag out' the anode current, *i.e.* to maintain it at a low value for a sufficient period just before the end of commutation, in order substantially to reduce residual ionization and the probability of arc-back.

621.314.671 **361**

Circuit Cushioning of Gas-Filled Grid-Controlled Rectifiers.—D. V. Edwards & E. K. Smith. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 640–643.) A small resistance and capacitance connected in series between the cathode and anode delays the rise of initial inverse voltage by a few microseconds, and therefore increases the life of the rectifier.

621.316.313.025 **362**

A New Design for the A.C. Network Analyzer.—J. D. Ryder & W. B. Boast. (*Trans. Amer. Inst. elect. Engrs.*, Oct. 1946, Vol. 65, No. 10, pp. 674–680.) A general description is given of the analyser, which operates at 10 000 c/s using standard radio components. The cost is therefore much less than for previous types operating at 400–500 c/s. See also 31 of January (Meyers & Schultz).

621.316.726.078.3 : 531.3 **363**

On the Theory of Frequency Stabilization.—S. M. Rytoff, A. M. Prokhoroff & M. E. Zhabotinski. (*Zh. eksp. teor. Fiz.*, 1945, Vol. 15, No. 10, pp. 557–571. In Russian.) In all investigations so far published on the operation of a valve oscillator containing a stabilizing element, simplifying assumptions are made regarding the linearity of the system under consideration. There are strong reasons to believe that good results can be obtained by using rigorous methods based on the Poincaré–Lyapunoff theory, although this is only applicable to slightly nonlinear systems, *i.e.* to systems with a small parameter μ determining the deviation of the system from linearity.

Accordingly, the operation of a pull-in system consisting of a valve oscillator inductively coupled to an LCR circuit (Fig. 1) is discussed from the standpoint of the theory. The properties of the LCR circuit necessary for it to act as a 'quartz' stabilizer are determined and a definition of stability is given.

The operation of pull-in crystal controlled oscillators with a capacitive coupling (Fig. 3, bottom) and of Pierce's oscillator (Fig. 3, top) is then considered, and equations (11) and (17) are derived for the two systems respectively; an analysis of the first system only is given. A periodic solution of equations (17) is found and its stability investigated. Formulae (24) and (26) determining the variation of the amplitude and of the frequency respectively are derived and it is shown that in the absence of anode reaction and grid current, the stabilization makes the frequency of oscillations independent of the valve parameters apart from second order effects. A numerical example of the calculation of the oscillation frequency is added. See also 377 below.

621.317.373 **364**

Phase Detectors: Some Theoretical and Practical Aspects.—Farren. (*See* 474.)

621.318.3[.4] .042 : 621.396 **365**

Coils, Cores, and Magnets: Part 1—Magnetic Design Factors of Modern Radio Components.—H. W. Schendel. (*Radio Craft*, Oct. 1946, Vol. 18, No. 1, pp. 30–31..47.)

621.318.4 : 538.12 **366**

Effective Impedance of a Sphere in a Magnetic Field.—T. S. E. Thomas. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 322–324.) "A conducting sphere in a uniform magnetic field may be regarded as being equivalent to a single-turn coil of the same diameter. Formulae are given for (*a*) the equivalent resistance and inductance of the coil, (*b*) the change in inductance and resistance of a solenoid when a sphere is placed at its centre, (*c*) the heat dissipated in a sphere in a uniform alternating magnetic field."

621.318.4.011.3 **367**

Calculating the Inductance of Universal-Wound Coils.—A. W. Simon. (*Radio, N.Y.*, Sept. 1946, Vol. 30, No. 9, pp. 18..31.) It is required to find the number of turns to produce a given inductance. For universal-wound coils this can be done by a method based on 1464 of 1945 (Simon).

621.392 : 621.396.645.029.64 **368**

Circuits for Use with Triode Amplifiers and Oscillators operating at U.H.F.—G. Lehmann. (*Onde élect.*, Oct. 1946, Vol. 26, No. 235, pp. 357–366.) A general paper in which the desirable electrical features of cavities and coaxial line derivatives are analysed. The design principles for the triode valve itself were discussed in an earlier paper (3821 of 1946). In the amplifier application the effects of the Q and impedance of the cavities on operation are considered, neglecting the effect of inter-cavity coupling *via* the grid screen. It is concluded that these circuit parameters should be high in the case of the anode (output) circuit, and low for the cathode (input) circuit. Possible ways of neutralizing the valve are considered in relation to the design of power amplifiers; experimental arrangements are outlined for achieving neutralization empirically. The circuit conditions necessary to ensure satisfactory operation of u.h.f. triode oscillators are considered. It is established that, for maximum energy dissipation at a fixed frequency in a given load, four independent adjustments are necessary and sufficient. One of these determines the operating frequency, the second, the impedance match of the load; the third and fourth fix the real and imaginary components of the transfer impedance from the anode to the cathode cavity. Means of making these adjustments in practice are discussed; the common use of an internal capacitive-type coupling between the cavities is criticized. Finally, the power output possibilities of triodes in the wavelength range 10–300 cm are summarized.

621.392.051 **369**

Conditions for Transfer of Maximum Power.—H. E. Ellithorn. (*Communications*, Oct. 1946, Vol. 26, No. 10, pp. 26–28..35.)

621.392.51 : 534.1 **370**

Violation of the Reciprocity Theorem in Linear Passive Electromechanical Systems.—E. M. McMillan. (*J. acoust. Soc. Amer.*, Oct. 1946, Vol. 18, No. 2, pp. 344–347.) It is shown by an energy argument that the theorem of reciprocity is satisfied by crystal or electrostatic transducers in both magnitude and sign, but in the case of magnetic or electrodynamic transducers it is satisfied only in magnitude. By combining these two types, systems can be constructed that violate reciprocity in magnitude.

621.394/.397].645.34 **371**

Radio Design Worksheet No. 53: Graphics of Negative Feedback in Cascade.—(*Radio, N.Y.*, Oct. 1946, Vol. 30, No. 10, pp. 17–18.)

621.394/.397].645.34 **372**

How Negative Feedback Operates.—C. A. A. Wass. (*P.O. elect. Engrs' J.*, Oct. 1946, Vol. 39, Part 3, pp. 114–116.) Demonstration by numerical and pictorial examples of the way in which negative feedback improves amplifier performance.

621.395.645 **373**

Three-Channel Amplifier: a 15-W Unit with Individual Control of Each Channel.—M. Contassot. (*Toute la Radio*, Jan. 1946, Vol. 13, No. 102, pp. 36–37.) A French version of 2845 of 1946.

621.395.661 **374**

Mica Capacitors for Carrier Telephone Systems.—A. J. Christopher & J. A. Kater. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 670–674.) Silvered mica capacitors are superior to the previous dry stack type, because of their relatively simple unit construction and ease of adjustment to the very close capacitance tolerance required. Construction details and performance characteristics are given.

621.396.61 : 538.56 : 535.23 **375**

The Radiation through an Aperture in a Resonator.—L. Mandelstam. (*Zh. eksp. teor. Fiz.*, 1945, Vol. 15, No. 9, pp. 471–473. In Russian.) An electromagnetic field is set up inside an ideal hollow conductor with infinitely thin walls and a circular aperture whose diameter is small compared to the wavelength. The radiation through the aperture is determined by a method similar to that used by Rayleigh for diffraction at a small aperture.

The following two auxiliary problems are solved first: (*a*) Given a flat capacitor with two infinite plates A and B at an infinite distance apart, and that plate B is infinitely thin and has a circular aperture in it, determine the additional field due to this aperture; (*b*) Given two ideally conducting infinitely thin plates A and B at an infinite distance apart, such that a current flows in plate A and, in the opposite direction, in plate B, and that a circular aperture is made in plate B, determine the distribution of the magnetic field

For the main problem, it is assumed that the tangential component of the field at the point where the aperture is to be made is H_0. It is shown that the field set up by the aperture at a great distance is that of a magnetic dipole with a moment $2a^3H_0/3\pi$ where a is the radius of the aperture. Similarly, if E_0 is the normal component of the electric field at the point where the aperture is to be made, the field due to the aperture is that of an electric dipole with a moment $a^3E_0/3\pi$.

621.396.611 **376**

Electromagnetic Cavities.—J. Bernier. (*Onde élect.*, Aug./Sept. 1946, Vol. 26, Nos. 233/234, pp. 305–317.) A mathematical paper. The natural modes of oscillation of cavities having infinitely conducting walls are first considered, particular attention being paid to resonators having mathematically convenient forms. An expression for the perturbation of the natural frequency of the resonator due to a small change in its shape is derived by two methods. The damping and frequency shift introduced by assigning a finite conductivity to the walls are determined. The fact that practical resonators have Q values lower than the theoretical is attributed either to oxidation or to the nature of the top few microns of the cavity walls. Finally the behaviour of cavities under conditions of forced oscillation is examined, and the nature of 'lumped value' equivalent circuits discussed.

621.396.611 : 531.3 **377**

On a Special Case of Systems with Two Degrees of Freedom.—M. E. Zhabotinski. (*Zh. eksp. teor. Fiz.*, 1945, Vol. 15, No. 10, pp. 573–585. In Russian.) If approximate methods are used for examining systems with two degrees of freedom, system equations are derived with small terms of the same (first) order of smallness as the small parameter μ. If however exact methods based on the Poincaré–Lyapunoff theory are applied, terms of higher orders of smallness may appear in the equations. In the present paper an analysis is made of the case when terms of any arbitrary orders may appear together with terms of the first order. Methods are indicated for finding a periodic solution of the system equations (1) for different cases, for example, when the system is operated with or without a stabilizing element, and conditions of stability are derived. It is shown that the calculations involved in the use of the exact methods are no more complicated than in the case of an equation with terms of the first order of smallness only. See also 363 above.

621.396.611 : 621.317.79.029.64 **378**

High Q Resonant Cavities for Microwave Testing.—I. G. Wilson, C. W. Schramm & J. P. Kinzer. (*Bell Syst. tech. J.*, July 1946, Vol. 25, No. 3, pp. 408–434.) An engineering approach to the design of tunable cylindrical cavities resonant in the *TE*01*n* mode which gives the maximum Q in a given volume. The dimensions to give as few unwanted modes as possible may be determined from charts. The suppression of the unwanted modes, particularly the *TM*11*n* mode which has the same frequency as the required mode, is discussed. Methods of coupling a *TE*10 waveguide to the cavity are given in tabular form. As a practical example an outline electrocoil design for an echo box is described and the mechanical requirements outlined. The uses of such a box for radar testing are indicated.

621.396.611.018.41 **379**

Theory and Measurements of the Natural Frequencies of Various Kinds of Resonant Cavities. [Thesis]—J. J. Verschuur. Drukkerij Waltman (A. J. Mulder), Delft, 1946. A mathematical and experimental investigation of the natural frequencies of symmetrical and asymmetrical cavity resonators, with particular reference to symmetrical 're-entrant' types (*i.e.* the space between two concentric cylinders). A method of analysis in terms of an equivalent LC circuit has proved to be much simpler than previous analyses, and has given theoretical values of resonant frequency within 5% of measured values. The measurements were made over the range 35–200 cm. A long summary in English is given (pp. 114–115) and a bibliography of 58 items is appended.

621.396.611.1 **380**

Mathematical Treatment of *n* Directly Coupled H.F. Oscillatory Circuits.—H. Behling. (*Funktech. Mh.*, May 1940, No. 5, pp. 75–80.) A general method is developed for obtaining the selectivity curve of any number n of directly coupled circuits and this is applied specially to the case of $n = 4$. Selectivity and amplification formulae are then given for $n = 2, 3, 6$. The selectivity curves for $n = 2, 4, 6$ present marked similarities, as also do those for $n = 3$ and 5. Numerical calculations are given for a 4-circuit filter.

621.396.611.21 : 537.228.1 : 534.13 **381**

General Dynamical Considerations applied to Piezoelectric Oscillations of a Crystal in an Electrical Circuit.—W. F. G. Swann. (*J. Franklin Inst.*, Sept. 1946, Vol. 242, No. 3, pp. 167–195.) A mathematical paper dealing with forced and free oscillations in an X-cut crystal. Electrical and mechanical damping effects are taken into account, but for certain solutions of practical interest, internal mechanical damping is neglected. An expression is developed for the mechanical displacement at the two ends of the crystal under resonant conditions. When the frequency of the applied e.m.f. is equal to the lowest natural frequency of the crystal (or to an odd harmonic thereof) the displacements at the two ends are equal, even when the media surrounding the two ends of the crystal are different. See also 3244 of 1946 (Ekstein).

621.396.615.1 **382**

Response of Oscillator to External E.M.F.—D. G. Tucker: R. E. Burgess. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 341–342.) Correspondence on 3216 of 1946. Tucker suggests that "it is not possible to consider the effective 'half-power' bandwidth of the system, nor to express it in terms of a linear tuned circuit." Burgess in reply amplifies his treatment and reasserts its validity for the conditions he specified.

621.396.62 **383**

Design and Application of Squelch Circuits.—Delanoy. (*See* 519).

621.396.62 **384**

Notes on the Design of Squelch Circuits.—Delanoy. (*See* 520.)

621.396.645.014.332 **385**

Class-B Amplifiers.—A. S. G. Gladwin. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, p. 343.) Extension of the method of 3563 of 1946 (Sturley) to the case when the grid excitation is of arbitrary waveform.

621.396.645.211 **386**

Improved Analysis of the RC Amplifier.—J. Roorda, Jr. (*Radio, N.Y.*, Oct. 1946, Vol. 30, No. 10, pp. 15–16.) New design formulae are developed rigorously, whereby analysis of resistance-coupled amplifier performance is simplified, and an equivalent circuit holding at all frequencies of the amplifier is obtained. A numerical example is given.

621.397.621 **387**

Deflector Coil Coupling.—Cocking. (*See* 558.)

GENERAL PHYSICS

530.13 : 530.12 **388**

A Relativistic Misconception.—C. R. Eddy. (*Science*, 27th Sept. 1946, Vol. 104, No. 2700, pp. 303–304.) "The idea that matter and energy are interconvertible is due to a misunderstanding of Einstein's equation $E = mc^2$ . . . In calculating the kinetic energy released or consumed by nuclear reactions from the formula $E = (\triangle m)c^2$, the rest masses and not the actual masses must be used in computing $\triangle m$." The total actual mass of the system is invariant.

530.145.63 **389**

On Dirac's Theory of Quantum Electrodynamics: the Interaction of an Electron and a Radiation Field.—C. J. Eliezer. (*Proc. roy. Soc. A*, 22nd Oct. 1946, Vol. 187, No. 1009, pp. 197–219.)

531.18 : 531.15 **390**

Is Rotation Relative, or Absolute?—B. A. Hunn: D. A. Bell. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 342–343.) Correspondence on 3564 of 1946 (G.W.O.H.).

532.13 : 537.29 **391**

The Effect of an Electric Field on the Viscosity of Liquids.—E. N. da C. Andrade & C. Dodd. (*Proc. roy. Soc. A*, 5th Nov. 1946, Vol. 187, No. 1010, pp. 296–337.) A description of apparatus for measuring this effect, in which the liquid runs in a narrow channel between plane metal boundaries which can be used as electrodes.

Measurements on polar and non-polar liquids are described and the observations are explained theoretically.

537.122 : 538.3 **392**

Calculation of the Field due to a Moving Electric Charge.—É. Durand. (*C. R. Acad. Sci., Paris*, 20th Nov. 1944, Vol. 219, No. 20, pp. 510–513.) It is shown that the method of calculation given by R. Reulos (4374 of 1937; *Cah. Phys., Paris*, 1941, No. 3, pp. 1–14.), which seems to differ essentially from the classical treatment, is in reality completely equivalent to it. See also 393 below and 356 above.

537.122 : 538.3 **393**

Calculation of the Field due to a Moving Electric Charge.—É. Durand. (*C. R. Acad. Sci., Paris*, 4th Dec. 1944, Vol. 219, No. 22, pp. 584–587.) The potential formulae previously given (see 392 above) are applied to the case where the trajectory remains within a spatially limited domain, the potentials being calculated outside this domain. A formula is derived for the radiation of the particle. Simplified potential formulae are given for small distances from the domain. For two charges symmetrical with respect to the origin the formulae yield the classical results for the dipolar oscillator.

537.291 **394**

Volt-Ampere Characteristics for the Flow of Ions or Electrons between Concentric Cylinders in Gases at Atmospheric Pressure.—C. W. Rice. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 228–229.)

537·533·73 **395**

Refraction Effects in Electron Diffraction.—J. M. Cowley & A. L. G. Rees. (*Nature, Lond.*, 19th Oct. 1946, Vol. 158, No. 4016, pp. 550–551.) Study of diffraction patterns of magnesium and cadmium oxide smokes with the R.C.A. type electron microscope. Results are explained in terms of variations of inner potential. See also 3697 of 1945 (Sturkey & Frevel).

538.3 **396**

Stresses in Magnetic and Electric Fields.—G. W. O. H. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 319–321.) A critical theoretical discussion setting forth the discrepancies between the results arrived at by various workers.

538.566 **397**

The Group Velocity in a Crystal Lattice.—L. Mandelstam. (*Zh. eksp. teor. Fiz.*, 1945, Vol. 15, No. 9, pp. 475–478. In Russian.) The group and phase velocities of waves propagated in a continuous medium have the same direction, and the group velocity is in this case said to be positive. There are, however, real media in which the velocities have opposite directions, *i.e.* the group velocity is negative. An analysis is made of the propagation of waves in a crystal lattice and it is shown that the group velocity $\frac{d\omega}{dk}$ is in this case negative (ω is the frequency and k the wave number). It is also shown that the velocity W of the propagation of energy, as defined by Rayleigh, is in this case equal to the group velocity. It is pointed out that the crystal lattice is a limiting case of a continuous medium with a periodically variable parameter, such as density, dielectric constant, etc. As an example the propagation of waves in the direction x in a medium the properties of which vary only with x is briefly considered.

539.185 **398**

Two Kinds of Neutrons?—J. De Ment. (*Science*, 27th Sept. 1946, Vol. 104, No. 2700, p. 303.) The usual neutron breaks down into a proton with the emission of a β-particle. Theory appears to require a second kind which would break down into a negative proton with the emission of a positive electron.

548.0 : 546.74 : 538 **399**

Magnetic Studies on Nickel Ions in Crystals.—A. Mookherji. (*Indian J. Phys.*, Feb. 1946, Vol. 20, No. 1, pp. 9–20.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

522.23 : 523.755 **400**

Scientists explore Sun.—M. G. Morrow. (*Sci. News Lett., Wash.*, 14th Sept. 1946, Vol. 50, No. 11, pp. 170–171.) Describes the use of a coronagraph at the High Altitude Observatory at Climax to observe continuously the solar corona.

523.165 **401**

An Observed Abnormal Increase in Cosmic-Ray Intensity at Lahore.—H. R. Sarna & O. P. Sharma. (*Nature, Lond.*, 19th Oct. 1946, Vol. 158, No. 4016, p. 550.) A threefold increase in directional total intensity of cosmic radiation was observed during the period 31st July–3rd Aug. 1946.

523.7 + 523.854] : 621.396.11 **402**

Extra-Tropospheric Influences on Ultra-Short-Wave Propagation.—E. V. Appleton. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 110–113.) The effect of the ionosphere and of radio noise of extraterrestrial origin is considered. Transient echoes from temporarily ionized scattering centres at about the level of the E layer are probably due to the ionization trails of meteorites. The scattering coefficient L (defined in Scott's paper 510 below) is about 100 m at 9 Mc/s, and very roughly L varies as $1/f^n$ where f is the frequency and n is about 2. Early experimental evidence of long-distance scatter with a delay time of 15 to 25 ms is now believed to be caused by waves which have been reflected by the F layer, scattered back, and then reflected again by the F layer. The limiting frequency for such scattering may be taken as 3.5 times the vertical-incidence F_2-layer critical frequency for the mid-point of the trajectory. Account must be taken of the general world morphology of F_2-layer ionization.

Galactic radio noise has been studied among others by Hey, Parsons & Phillips (see 3599 of 1946 and back reference) while L. A. Moxon and J. M. C. Scott have found that galactic noise power varies roughly as the square of the wavelength for frequencies above about 20 Mc/s.

Solar radio noise in excess of the expected black-body intensity by a factor as great as 10^5 or 10^6 on metre wavelengths, and connected with sunspot activity, has frequently been reported recently, as in 403 below. Such noise is not appreciable at centimetre wavelengths. It is sometimes convenient to express results in terms of the ' equivalent black-body temperature ' of the noise source. The pioneer work in this field was done by Burgess (see 438 of 1942 and back references).

523.72 : 621.396.822 **403**

Noise during Radio Fade-Outs.—O. P. Ferrell. (*Terr. Magn. atmos. Elect.*, Sept. 1946, Vol. 51, No. 3, p. 449.) A survey of observations of solar noise discussed more fully in 402 above.

523.72 : 621.396.822.029.62 **404**

Conditions of Escape of Radio-Frequency Energy from the Sun and the Stars.—M. N. Saha. (*Nature, Lond.*, 19th Oct. 1946, Vol. 158, No. 4016, p. 549.) The minimum frequency of electromagnetic waves that can escape from various layers of the sun, and from sunspots, is calculated from Appleton's magneto-ionic theory. It is concluded that the ordinary wave cannot escape, and that the larger sunspots are most favourable for the escape of extraordinary waves in the frequency range 10–200 Mc/s; therefore radio waves reaching the earth should be circularly polarized.

523.72 : 621.396.822.029.62 **405**

Abnormal Solar Radiation on 75 Megacycles.—S. E. Williams & P. Hands. (*Nature, Lond.*, 12th Oct. 1946, Vol. 158, No. 4015, p. 511.) Observations on the nature of solar radiation on 75 Mc/s were made during periods of sunspot activity in July and August 1946. The radiation can be roughly divided into two components, one slowly variable, and the other abruptly variable, and showing correlation with visual solar observations. Correlation between solar noise and prominence activity seems probable. Short abstract only. See also 406.

523.72 : 621.396.822.029.62 **406**

Abnormal Solar Radiation on 72 Megacycles.—A. C. B. Lovell & C. J. Banwell. (*Nature, Lond.*, 12th Oct. 1946, Vol. 158, No. 4015, pp. 517–518.) Experimental data on a frequency of 72.6 Mc/s obtained during July and August 1946 confirm that solar radiation on radio frequencies can be as much as 10^8 times the black body value; this appears to be associated with solar flares. See also 405 above, 86 of January and back references.

523.78 : 551.510.535 **407**

Effects on the Ionosphere at Huancayo, Peru, of the Solar Eclipse, January 25, 1944.—Ledig, Jones, Giesecke & Chernosky. (*See* 503.)

523.78 : 551.510.535 **408**

Eclipse-Effects in F_2-Layer of the Ionosphere.—Wells & Shapley. (*See* 502.)

538.566.3 + 621.396.812 **409**

Observations on the Interaction of Waves in the Ionosphere, in relation to the Gyrofrequency.—Cutolo, Carlevaro & Gherghi. (*See* 513.)

538.71 **410**

The Development and Applications of Airborne Magnetometers in the U.S.S.R.—A. A. Logachev. (*Geophys.*, April 1946, Vol. 11, No. 2, pp. 135–147.) Translation of three papers describing the pioneer work by the Russians in magnetic exploration with airborne equipment.

550.38(091) **411**

Chapters in the History of Terrestrial Magnetism.—A. C. Mitchell. (*Terr. Magn. atmos. Elect.*, Sept. 1946, Vol. 51, No. 3, pp. 323–351.)

550.385 : 525.241 **412**

The Mean Field of Disturbance of Polar Geomagnetic Storms.—L. Harang. (*Terr. Magn. atmos. Elect.*, Sept. 1946, Vol. 51, No. 3, pp. 353-380.)

551.501.7 **413**

Measurements of Refractive Index Gradient.—F. L. Westwater. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 100–101.) Three yachts were equipped to take temperature and humidity observations in the first 200 ft in connexion with the Cardigan Bay experiments described in 518 below. Pairs of dry and wet copper-constantan thermocouples fitted in double radiation shields were mounted on the masts at heights of 25 ft, 40 ft and 50 ft, and on 10-ft booms projecting over the ship's side at heights of 5 ft, 10 ft, and 15 ft respectively. For temperature readings, each dry thermocouple was compared electrically with a standard thermocouple; for humidity readings, with its corresponding wet thermocouple. Readings were taken at half-hourly intervals. Sea temperature was also measured by means of a thermocouple, and checked by direct reading from sea water in a bucket. Similar thermocouples were also fitted to a barrage balloon, readings being taken at 50-ft intervals up to 200 ft. The measurements reveal very complex conditions. Sharp discontinuities are common. Similar measurements on a barrage balloon at Cardington revealed a very sharp temperature discontinuity occurring across a subsidence inversion.

551.510.53 **414**

The Basic Reactions in the Upper Atmosphere: Part 1.—D. R. Bates & H. S. W. Massey. (*Proc. roy. Soc. A*, 5th Nov. 1946, Vol. 187, No. 1010, pp. 261–296.) " The properties of the upper atmosphere and in particular of the ionosphere and of the night-sky emission are outlined. The fundamental processes that might be involved are discussed. Various suggestions regarding the production of the layers are considered in detail and the main difficulties indicated. The theory of the equilibrium of the layers is built up and the outstanding problem of explaining the rate of disappearance of electrons is emphasized. Current views on the origin of the night-sky light are studied critically and serious discrepancies are shown to exist. Other possibilities are examined." An extensive bibliography is appended.

551.510.535 **415**

On Diffusion in the Ionosphere.—V. C. A. Ferraro. (*Terr. Magn. atmos. Elect.*, Sept. 1046, Vol. 51, No. 3, pp. 427–431.) " It is shown that Jaeger's discussion of diffusion in the ionosphere [598 of 1946] is applicable only to regions of the F_2 layer 100 km or more above the level of maximum ion-production. Further reasons are given for the conclusion reached in an earlier paper [3785 of 1945] that, though diffusion in the F_2 layer may not be negligible (as in the case of the E and F_1 regions), its effect is likely to be small. The air-density in the F_2 layer at the level of maximum electron-density is then unlikely to be much less than 10^{10} mol per cc."

551.510.535 **416**

The Mechanism of Ionospheric Ionization.—R. v. d. R. Woolley. (*Proc. roy. Soc. A*, 8th Oct. 1946, Vol. 187, No. 1008, pp. 102–114.) " The available mechanisms for the production of electrons in the three regions of the ionosphere are discussed with special reference to the question whether it is possible to account for the observed electron densities without supposing that the sun emits far more energy in the remote ultra-violet spectrum than would be emitted by a black body at 6 000°. The contributions to electron densities made by metastable states of atoms and molecules are examined. It is concluded that the observed electron densities may be accounted for without requiring high solar energy in the ultra-violet if the effective recombination coefficient in the F_2 region is 10^{-11}. The F_2 region is attributed to the ionization of atomic oxygen, and the E region to the ionization of molecular oxygen. The electrons forming the F_1 region are supposed to be provided by metastable N_2 or by NO."

551.594.51 **417**

The Auroral Luminosity-Curve.—L. Harang. (*Terr. Magn. atmos. Elect.*, Sept. 1946, Vol. 51, No. 3, pp. 381–400.) The auroral luminosity curve is calculated theoretically as a function of height for cathode rays penetrating the ionosphere rectilinearly. Estimates are made of cathode-ray velocities for observed aurorae, and the heights of abnormal-E reflections and of the absorbing layer are discussed.

621.396.812.029.64 **418**

Elements of Radio Meteorology : How Weather and Climate cause Unorthodox Radar Vision beyond the Geometrical Horizon.—Booker. (*See* 516.)

621.396.812.029.64 **419**

The Attenuation of Centimetre Radio Waves and the Echo Intensities resulting from Atmospheric Phenomena.—Ryde. (*See* 515.)

551.510.535 (02) **420**

Contribution à l'Étude de la Structure de l'Ionosphère. (Mémoires de l'Institut Royal Météorologique de Belgique, Vol. 19.) [Book Review]—M. Nicolet. Institut Royal Météorologique de Belgique, Brussels, 1945, 162 pp. (*Observatory*, Oct. 1946, Vol. 66, No. 834, pp. 345–346.)

LOCATION AND AIDS TO NAVIGATION

621.396 : 629.13 **421**

Aviation Radio Equipment.—(*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 366–368.) The main types of radio equipment shown at the exhibition of the Society of British Aircraft Constructors were : general purpose communication sets, v.h.f. apparatus, radio aids to navigation, airborne power supply units, and electronic equipment for balancing gyroscope rotors and for flaw detection.

621.396.9 **422**

I.E.E. Radiolocation Convention, March 1946.—(*See* 603.)

621.396.9 : 623.451 : 551.46 **423**

Properties of Radar Echoes from Shell Splashes.—H. Goldstein. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 232–233.) Scattering from spray drops has been suggested as the explanation of sea echo on microwave radar. Experiments on echoes from shell splashes are described which provide further evidence that this is not the case. Wavelengths of 9.2, 3.2 and 1.25 cm were used and a high speed photographic technique employed to compare the echo intensities ; simultaneous motion pictures of the splashes were also taken with a cine-theodolite.

The effective cross-section of the splash at any instant could be calculated, and a detailed comparison of the results on 9.2 and 1.25 cm was made. The cross-section was initially greater on 9.2 cm, but as the splash changed to spray this condition was reversed, and the 1.25 cm echo was still appreciable after the other had disappeared. The ratio of the cross-sections for very fine drops is given by the Rayleigh λ^{-4} law as +35 db, whereas the maximum value measured was about +20 db. This is still much greater than the +8 db observed for sea echo, which therefore cannot arise from small drops of spray.

621.396.9 (52) **424**

Short Survey of Japanese Radar : Parts 1 & 2.—R. I. Wilkinson. (*Elect. Engng, N.Y.*, Aug./Sept. & Oct. 1946, Vol. 65, Nos. 8/9 & 10, pp. 370–377 & 455–463.) A report based on a study made immediately after the fall of Japan by the U.S. Army, which was particularly useful because of the obvious willingness of the Japanese to volunteer technical information. Army and navy radar are discussed, together with general problems concerning the manufacture and operation of radar equipment.

621.396.932 **425**

The SL Radar.—N. I. Hall. (*Bell Lab. Rec.*, Oct. 1946, Vol. 24, No. 10, pp. 353–357.) A brief descriptive account of a shipborne 10 cm radar system with p.p.i. display, designed in 1942 for submarine detection.

621.396.933 **426**

Air Navigation : Survey of Radio Aids to Civil Aviation.—M. G. Scroggie. (*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 352–356.) The principal types of navigational aid at present available are briefly discussed. The main immediate need is for world-wide standardization and coordination of these equipments to reduce the number that aircraft must carry. Attempts are also being made to replace cathode-ray tube displays developed during the war by meters which give the pilot a direct reading of the information he requires.

621.396.933.4 **427**

Anti-Collision Radio.—H. W. Secor & E. Leslie. (*Radio Craft*, Oct. 1946, Vol. 18, No. 1, pp. 17..75.)

621.396.933(02) **428**

Demonstrations of Radio Aids to Civil Aviation. [Book Review]—H.M. Stationery Office, London, 80 pp., 5s. (*Wireless Engr*, Nov. 1946, Vol. 23, No. 278, p. 298.) Descriptions of equipments shown to delegates of the Provisional International Civil Airways Organization.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.275.083 **429**

Measuring Humidity in Air and Gases by the Dew-Point Method.—R. Czepek. (*Arch. tech. Messen*, Aug. 1940, No. 108, pp. T85–86.) A review of the principles and brief description of seven practical methods.

533.5 : 621.3.032.53 **430**

Stresses in Cylindrical Glass-Metal Seals with Glass Inside.—A. W. Hull. (*J. appl. Phys.*, Aug. 1946, Vol. 17, No. 8, pp. 685–687.) The stresses in the glass are shown to be all of the same sign and thus a moderate mismatch is allowable when the thermal expansion of the metal is greater than that of the glass. The theory is given in an earlier article : Glass to Metal Seals, by A. W. Hull & E. E. Burger (*Physics*, 1934, Vol. 5, pp. 387 ff). See also 431 below.

533.5 : 621.3.032.53 **431**

Theory and Practice of Glass-Metal Seals : Part 4.—J. A. Monack. (*Glass Ind.*, Nov. 1946, Vol. 27, No. 11, pp. 556–559..582.) For previous parts see 119 of January. See also 430 above.

535.37 **432**

Fluorescence Fatigue.—T. Alper. (*Nature, Lond.*, 28th Sept. 1946, Vol. 158, No. 4013, p. 451.)

537.533.8 **433**

The Change in Conductivity of Aluminium Oxide when it is bombarded by Electrons.—I. F. Kvartskhava. (*Bull. Acad. Sci. U.R.S.S.*, *sér. phys.*, 1944, Vol. 8, No. 6, p. 373. In Russian.) Summary of a report. In studying secondary electron emission it is important to observe the excitation of electrons in the emitter by primary electrons. Certain experimental difficulties are obviated by the use of aluminium oxide emitters. In experimenting with these it was found that with gradients of the order of 10^6 V/cm a process takes place in the emitter causing an increase in the dark conductivity and a decrease in the excitation of the electrons.

539.23 : 669 **434**

Identification of Electroplated Coatings.—(*Materials & Methods*, Sept. 1946, Vol. 24, No. 3, p. 673.) Table of simple identification tests involving scratching, spot tests with concentrated HNO_3 and HCl, and other chemical tests.

539.234 **435**

Structure of Catalytic Metal Films.—D. D. Eley. (*Nature, Lond.*, 28th Sept. 1946, Vol. 158, No. 4013, p. 449.) When certain metals evaporate on to the walls of a glass tube, films are formed whose actual area is several times their apparent area. This is best explained by assuming such films to be microcrystalline.

546.287 **436**

Silicones: Food for Imagination.—R. R. McGregor. (*J. Franklin Inst.*, Aug. 1946, Vol. 242, No. 2, pp. 93–102.) Address to a joint meeting of the Franklin Institute and the Philadelphia Science Teachers' Association.

620.191.33 : 669.3 **437**

Microfissures.—" Recorder II ". (*Metal Ind., Lond.*, 25th Oct. 1946, Vol. 69, No. 17, p. 347.) Fine cracks otherwise invisible in impure copper or copper alloy specimens can be detected microscopically if the specimens are electrolytically polished and immersed in a special ammonium sulphide reagent.

620.193.8(213) **438**

The Deterioration of Materiel in the Tropics.—W. G. Hutchinson. (*Sci. Mon., N.Y.*, Sept. 1946, Vol. 63, No. 3, pp. 165–177.) A brief résumé of the ways in which different classes of materiel are affected. Some possible measures of control are indicated.

621.315.211.2 : 679.5 **439**

Developments in Solid Dielectric R.F. Transmission Lines.—Graham. (*See* 351.)

621.315.6 : 621.39 **440**

Dielectrics for Telecommunication Purposes.—W. Jackson. (*Engineering, Lond.*, 1st Nov. 1946, Vol. 162, No. 4216, pp. 427–428.) Another account of part 2 of 314 of January.

621.315.61.015.5 : 547 **441**

Determination of the Flashpoint of Organic Insulating Materials.—M. Zürcher. (*Schweiz. Arch. angew. Wiss. Tech.*, March 1945, Vol. 11, No. 3, pp. 94–96.) Powdered materials in tubular containers are inserted in holes in a copper block pre-heated to a known temperature Any gases given off are collected and tested for combustibility. The sensitivity of the apparatus and the effect of grain size are discussed and results given graphically for certain materials.

621.315.612.2 : 551.547 **442**

Investigation of Porcelain Insulators at High Altitudes.—C. V. Fields & C. L. Cadwell. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 656–660.) Flashover voltages are given for a.c. and d.c. for porcelain bushings. Tests were made at both normal and reduced pressure. Solid insulation should be used to obtain the benefit of its puncture strength rather than its flashover under extreme conditions.

621.315.615.2 **443**

The Influence of the Concentration and Mobility of Ions on Dielectric Loss of Insulating Oils.—B. P. Kang. (*Trans. Amer. Inst. elect. Engrs*, July 1946, Vol. 65, No. 7, pp. 403–407.) The relationships between the amount of impurities, the viscosity, and the dielectric loss in insulating oils are investigated.

621.315.617.3 **444**

Insulating Varnishes and Compounds.—N. Bromberger. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1946, Vol. 7, No. 10, pp. 4–12. Discussion, pp. 12–14.) The selection and characteristics of both natural and synthetic materials are outlined, and details are given of the processes involved in the manufacture of varnishes and compounds. Their application and methods of production control are also discussed.

621.318.22/.23 **445**

Modern Hard Magnetic Materials.—K. Hoselitz. (*Metal Treatm.*, Autumn 1946, Vol. 13, No. 47, pp. 213–222.) Reprint of 2607 of 1946.

621.319.7 : 621.385 **446**

Plotting Electrostatic Fields.—G. Silva. (*Alta Frequenza*, June 1946, Vol. 15, No. 2, pp. 117–118.) Comment on 3322 of 1946 (Pinciroli & Panetti).

621.357.1 : 666.1 : 621.314.67 **447**

Electrolysis Phenomena in Soft-Glass Stems of Rectifier Tubes.—J. Gallup. (*J. Amer. ceram. Soc.*, 1st Oct. 1946, Vol. 29, No. 10, pp. 277–281.) The longitudinal cracks and black deposits which form along the leads during the life of rectifier tubes were found to be due to electrolysis in the soft glass stems. Rupture was caused by glass bombardment by reverse emission from the rectifier anode. This theory is supported by mass spectrometer analysis of the gas produced. Associated electrolysis phenomena are also described.

621.357.7 : 669.3 **448**

Copper Plating.—C. Struyk & A. E. Carlson. (*Metal Ind., Lond.*, 25th Oct. 1946, Vol. 69, No. 17, pp. 348–352.) Description of the advantages of using copper fluoborate solutions with high limiting current densities for the electrodeposition of copper, instead of the ordinary copper sulphate solutions.

621.791.353 **449**

Soft Soldering.—" Recorder II ". (*Metal Ind., Lond.*, 6th Dec. 1946, Vol. 69, No. 23, p. 476.) Survey of progress of investigations into the problem of ' solderability.'

666.1 : 62 **450**

Modern Developments in Glasses for Technical Purposes.—W. E. S. Turner. (*Endeavour*, Jan. 1945, Vol. 4, No. 13, pp. 3–16.) Recent discoveries of chemical, thermal and mechanical properties are described and the use of glass in combination with metals and as fibre is discussed.

666.1.032 **451**

Scientific Glass Blowing and Laboratory Techniques.—W. E. Barr & V. J. Anhorn. (*Instruments*, Jan. 1946, Vol. 19, No. 1, pp. 14–32.) To be continued.

666.11 **452**

Dielectric Properties of Glasses at Ultra-High Frequencies and Their Relation to Composition.—L. Navias & R. L. Green. (*J. Amer. ceram. Soc.*, 1st Oct. 1946, Vol. 29, No. 10, pp. 267–276.) The dielectric constants and dielectric losses of 104 kinds of glass were measured at 3 000 and 10 000 Mc/s by the resonant cavity method. SiO_2 and B_2O_3 glasses are relatively transparent at these frequencies. Alkali ions in glasses give high losses increasing with the number of ions. Glasses containing a combination of alkalis show lower losses than the equivalent compositions with only one alkali. Divalent ions contribute less to losses than alkalis.

666.3 : 539.4 **453**

Stress-Strain Relations in Ceramic Materials.—M. Lassettre & J. O. Everhart. (*J. Amer. ceram. Soc.*, 1st Sept. 1946, Vol. 29, No. 9, pp. 261–266.)

678.77 **454**

Some Recent Contributions to Synthetic Rubber Research.—C. S. Fuller. (*Bell Syst. tech. J.*, July 1946, Vol. 25, No. 3, pp. 351–384.)

679.5 **455**

Annealing of Styrene and Related Resins.—J. Bailey. (*Mod. Plast.*, Oct. 1946, Vol. 24, No. 2, pp. 127–131.) Failure of parts caused by thermal and mechanical strains can be overcome by the use of appropriate annealing processes.

679.5 **456**

Manufacture of Laminates in Germany.—(*Mod. Plast.*, Oct. 1946, Vol. 24, No. 2, pp. 147–149..210.) Translation based on a production manual of Dynamit A.-G., Troisdorf, a subsidiary firm of I. G. Farbenindustrie A.-G.

679.5 : 62 **457**

Plastic Laminates — as Engineering Materials.—K. Rose. (*Materials & Methods*, Sept. 1946, Vol. 24, No. 3, pp. 653-664.) Comprehensive article dealing with the industrial aspect of these materials, with their light weight, high dielectric strength, low water absorption and resistance to attack by chemicals. They can be supplied in sheets, rods and tubes, and other forms. The production of high-pressure, low-pressure and composite laminates is described, with their particular industrial uses, and details concerning the machining of these materials.

679.5 : 669 **458**

Metal Test Specimens mounted in Urea.—(*Mod. Plast.*, Oct. 1946, Vol. 24, No. 2, p. 121.) Metal specimens must be mounted for certain microscope tests. Moulded Plaskon is an economical mounting material which is easy to use, and can be coloured.

778.534.8 **459**

A System for Rapid Production of Photographic Records.—F. M. Brown, L. L. Blackmer & C. J. Kunz. (*J. Franklin Inst.*, Sept. 1946, Vol. 242, No. 3, pp. 203–212.) Equipment for automatic exposure, processing, and projection of 16 mm film is described. The final image is completely processed in 15 sec on Eastman Fine Grain Release Positive Film Type 5302.

MATHEMATICS

517.942 **460**

Mathieu Functions and Their Classification.—N. W. McLachlan. (*J. Math. Phys.*, Oct. 1946, Vol. 25, No. 3, pp. 209–240.)

518.5 **461**

The Automatic Sequence Controlled Calculator: Parts 1 & 2.—H. H. Aiken & G. M. Hopper. (*Elect. Engng, N.Y.*, Aug./Sept. & Oct. 1946, Vol. 65, Nos. 8/9 & 10, pp. 384–391 & 449–454.) See also 468 below.

518.5 **462**

The ENIAC, an Electronic Computing Machine.—D. R. Hartree. (*Nature, Lond.*, 12th Oct. 1946, Vol. 158, No. 4015, pp. 500–506.) General description with examples of operations.

518.61 **463**

An Escalator Process for the Solution of Linear Simultaneous Equations.—J. Morris. (*Phil. Mag.*, Feb. 1946, Vol. 37, No. 265, pp. 106–120.) The Escalator process, originally devised for the solution of Lagrangian frequency equations in connection with aircraft vibration problems (see 1636 of 1945) is adapted to the solution of linear simultaneous equations, particularly those which are 'ill-conditioned' and difficult to solve by other methods. Each of the variables involved is introduced in turn by definite self-contained stages, at each of which powerful checks are available to assess, and if necessary to adjust, accuracy. A numerical example is fully explained.

The Escalator method has a very wide application to vibration problems because it enables the various parts of a complicated system to be considered separately. It has also an application to networks and transients, but further work is necessary to make this fully effective. A comprehensive account of the method will be published in book form shortly.

519.2 : 518.4 **464**

Graphical Solutions of Statistical Problems.—F. Levi. (*Engineer, Lond.*, 18th & 25th Oct. 1946, Vol. 182, Nos. 4736 & 4737, pp. 338–340 & 362–364.) Discusses the applications of 'probability graph paper'.

519.28 : 621.3 **465**

A New Approach to Probability Problems in Electrical Engineering.—H. A. Adler & K. W. Miller. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 630–632.)

531.3 : 621.396.611 **466**

On a Special Case of Systems with Two Degrees of Freedom.—Zhabotinski. (*See* 377.)

51(02) **467**

The Common Sense of the Exact Sciences. [Book Review]—W. K. Clifford. A. A. Knopf, New York, 249 pp., $4.00. (*Sci. Mon., N.Y.*, Sept. 1946, Vol. 63, No. 3, p. 242.) "Mathematics made easy."

518.5 **468**

A Manual of Operation for the Automatic Sequence Controlled Calculator. (Annals of the Computation Laboratory of Harvard University, Vol. 1.) [Book Review]—Staff of the Computation Laboratory. Harvard Univ. Press, Cambridge, Mass.; Oxford Univ. Press, London, 561 pp., $10. (*Nature, Lond.*, 26th Oct. 1946, Vol. 158, No. 4017, pp. 567–568.) The machine described can be regarded as a modern version of Babbage's difference engine, and "is largely composed of standard Hollerith counters, but with a superimposed and specially designed tape sequence control for directing the operations of the machine". See also 461 above.

518.61 **469**

Relaxation Methods in Theoretical Physics. [Book Review]—R. V. Southwell. Clarendon Press, Oxford, 248 pp., 20s. (*Electrician*, 25th Oct. 1946, Vol. 137, No. 3569, p. 1137.) It is claimed that any problem that can be formulated can be solved arithmetically. See also 463 above.

MEASUREMENTS AND TEST GEAR

621.317.2 : 656.2 **470**

Mobile Electrical Measurements Laboratories for the German State Railways.—E. W. Curtius. (*Arch. tech. Messen*, Aug. 1940, No. 108, pp. T93–94.) Choice of test gear and of methods of measurement is limited mainly by the essential requirement of robust equipment that can withstand the severe vibrations encountered in railway rolling-stock.

621.317.32 : 537.221 **471**

Measurement of Surface Potential or Contact Potential Differences.—A. A. Frost. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, pp. 266–268.) The term surface potential is preferable when surface effects are being studied. Such potentials may conveniently be measured by forming the two surfaces into a capacitor whose charge is neutralized by an opposing potential supplied by a *p*H meter. See also 1282 of 1946 (Meyerhof & Miller).

621.317.32.027.3 **472**

High-Voltage Measurement.—F. M. Bruce. (*Elect. Rev., Lond.*, 22nd Nov. 1946, Vol. 139, No. 3600, p. 838.) Summary of two I.E.E. papers, one discussing factors in the design of an ellipsoid voltmeter, and the other describing spark gap calibration.

621.317.35 : 621.396.611.1.015.3 **473**

Evaluation of Circuit Constants from Oscillograms.—L. S. Foltz. (*Elect. Engng, N.Y.*, Oct. 1946, Vol. 65, No. 10, pp. 490–492.) Formulae are derived and applied to typical oscillograms of transients in series circuits, and it is shown that the results (values of the resistance, capacitance, and inductance present) have an accuracy which makes the formulae and the method useful.

621.317.373 **474**

Phase Detectors : Some Theoretical and Practical Aspects.—L. I. Farren. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 330–340.) Fundamental methods were described by Levy (2323 of 1940). In the present paper, a detailed analysis shows that simple push-pull detectors are more efficient than the balanced type. Simple push-pull detectors with sinusoidal input voltages have good sensitivity, but a sinusoidal relationship between the output and the phase-difference of the input voltages ; this relationship is more nearly linear in the square-wave case, but sensitivity is less.

621.317.39.029.6 : 536.33 **475**

The Measurement of Thermal Radiation at Microwave Frequencies.—R. H. Dicke. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, pp. 268–275.) The connection between 'Johnson noise' and black-body radiation is discussed, using a simple thermodynamic model. A suitable microwave receiver assembly with a wide-band i.f. amplifier is described in which the effect of radio noise generated in the apparatus is eliminated.

The experimentally measured r.m.s. fluctuation of the output meter of such a microwave radiometer is 0.4°C, compared with a theoretical value of 0.46°C.

The method of calibrating, using a variable temperature resistive load, is described. See also 219 of January (Kyhl, Dicke & Beringer).

621.317.728 **476**

Measurement of R.M.S. Voltage using a Sphere Gap.—W. Raske. (*Arch. tech. Messen*, April 1940, No. 106, p. T42.) Methods of adapting a sphere gap, used for peak voltage measurement, to find the r.m.s. value. Calibration and errors are discussed.

621.317.75 **477**

Frequency Spectrum Analysis : Principles and Applications.—E. Aisberg. (*Toute la Radio*, Dec. 1945, Vol. 12, No. 101, pp. 9–12.) An account of the construction and operation of an analyser suitable for studying the frequency characteristics of the various circuits in radio receivers.

621.317.79.029.64 **478**

Techniques and Facilities for Microwave Radar Testing.—E. I. Green, H. J. Fisher & J. G. Ferguson. (*Bell. Syst. tech. J.*, July 1946, Vol. 25, No. 3, pp. 435–482.) Reprint of 2645 of 1946.

621.317.79.029.64 : 621.396.611 **479**

High Q Resonant Cavities for Microwave Testing.—Wilson, Schramm & Kinzer. (*See* 378.)

621.318.572 **480**

Counting Rate and Frequency Meter.—E. Lorenz, J. Weikel & S. G. Norton. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, pp. 276–279.) A counting rate and frequency meter consists essentially of an apparatus for bringing signals of different amplitudes and waveforms to a uniform unidirectional size and measuring their rate of arrival. The instrument described has a resolving power of 10^{-5} sec for evenly spaced pulses and consists of a thyratron whose rate of striking is controlled by the input pulses, while the duration of the arc at each discharge is fixed by an RC circuit. The resulting anode current is thus proportional to the frequency of the input pulses.

621.319.4 : 621.317 **481**

The Characteristics and Errors of Capacitors used for Measurement Purposes.—C. G. Garton. (*J. Instn elect. Engrs*, Part II, Oct. 1946, Vol. 93, No. 35, pp. 398–408. Discussion, pp. 408–414.) Causes of variation of capacitance and loss angle are discussed with relation to time, humidity, temperature, frequency, voltage, screening, and the properties of materials used in capacitor construction. When a guard ring is used to measure the capacitance and loss angle of a plane sample of dielectric, errors in loss angle due to surface conductivity are small only if $g \ll t$, $g \ll R$, or $r > 10^{17}/Rf$ where $2g$ is the guard ring gap, t is the thickness of the sample, R is the radius of the main electrode, and f is the frequency. These conditions are difficult to realize in practice, and if none of them is satisfied, spurious loss angles up to 10^{-2} may occur in specially unfavourable cases.

621.396.611.21.012.8 : 537.228.1 **482**

Methods of Measuring the Constants of the Equivalent Network of a Piezoelectric Crystal : Quartz Meter.—Jacquinot, Dumesnil & Boughon. (*Onde élect.*, July 1946, Vol. 26, No. 232, pp. 259–273.) The equivalent circuit has components L, C and R in series with C_p in shunt. The natural frequency and bandwidth give the magnification Q. The time constant $\tau = 2L/R$ is determined by observing the decay of free oscillations in the crystal when the excitation is removed and a fluxmeter integrator gives direct indication of τ. The bandwidth is measured as the difference of the 'quadrantal' frequencies at which phase displacements of ±45° are obtained relative to the resonant frequency and c.r.o. indication is used. The dynamic resistance is determined by comparison with a known resistance (using c.r.o. indication). The various methods of measurement are combined in a single instrument (a universal Quartz meter) for use between 50 kc/s and 10 Mc/s.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

536.48 **483**

On the Possible Use of Brownian Motion for Low Temperature Thermometry.—A. W. Lawson & E. A. Long. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, pp. 220–221.) Thermal noise in a high resistance is only suitable for measuring temperatures down to about 0.01°K and requires an amplifier of very narrow pass band; the resistance, necessarily of a semiconductor, will have an exponential temperature coefficient which introduces difficulties.

Alternatively by measuring the thermal noise voltage of a quartz resonator (after calibration at the boiling point of helium) temperatures as low as 0.000 1°K should be measurable. The main experimental difficulty is to establish thermal contact between the resonator and its surroundings without reducing its Q.

539.16.08 **484**

Design of Beta-Ray and Gamma-Ray Geiger-Müller Counters.—W. Good, A. Kip & S. Brown. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, pp. 262–265.)

539.16.08 : 57 **485**

An Electronic Method of Tracing the Movements of Beetles in the Field.—G. A. R. Tomes & M. V. Brian. (*Nature, Lond.*, 19th Oct. 1946, Vol. 158, No. 4016, p. 551.) A beetle is made to carry 5 μgm of radium sulphate; its position is then detected with a special form of Geiger-Müller tube.

615.84 **486**

Crystal-Controlled Diathermy.—R. L. Norton. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 113–115.) Description of a 500-W unit operating at about 27 Mc/s, crystal frequency being a quarter of carrier frequency. An air-cooled tetrode is used in the output stage to which the load is connected by means of leads 4 ft in length. Provision is made for tuning the load: a lamp, loosely coupled to the output leads, is used as an indicator.

621.316.9 : 621.38 **487**

Electronic Devices in Power Supply.—"Kilovar". (*Overseas Engr*, Dec. 1946, Vol. 20, No. 231, pp. 155–157.) A general account of the protection of large high voltage power supply networks by electronic devices, and their use in telemetering, fault location, and so on.

621.318.572 **488**

Electronic Relay.—G.G.C. Development Co. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, p. 247.) When the control contact is open the anode and grid of a valve are fed with a.c. in antiphase. Closure of this contact earths the grid and causes anode-current to flow thus operating the relay. The maximum current through this contact is 15 μA.

621.318.572 : 623.451 **489**

A Paper Screen signaling Missile Passage in Ballistics.—H. Lamport & M. G. Schorr. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, p. 280.)

621.365.036.65 **490**

A Simple Automatic Furnace Temperature Control.—E. L. Yates. (*J. sci. Instrum.*, Oct. 1946, Vol. 23, No. 10, pp. 229–231.) By using a platinum resistance thermometer in an a.c. bridge, furnace temperature can be automatically controlled to within ±0.5°C at all temperatures between 0°C and 1 000°C.

621.365.92 : 677 **491**

Radio Heating in Textile Industry.—C. N. Batsel. (*Radio News*, Oct. 1946, Vol. 36, No. 4, pp. 44–45.. 82.) High frequency heating is used for processing cotton, rayon, nylon and wool, mainly for drying and setting the twist. A method has also been developed for curing the resin in impregnated fabrics.

621.38 : 62 **492**

Electronics: Their Scope in Heavy Engineering.—W. G. Thompson. (*G.E.C.J.*, Aug. 1946, Vol. 14, No. 2, pp. 59–72.) A survey of various types of electronic equipment, and their application to research, testing, manufacture, power control, and safety in heavy engineering.

621.38.001.8 : 621.9 **493**

Electronics and Precision Grinding Machines.—(*Engineer, Lond.*, 4th Oct. 1946, Vol. 182, No. 4734, pp. 300–301.)

621.384 : 538.691 **494**

The Stability of Electron Orbits in the Synchrotron.—N. H. Frank. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol 70, Nos. 3/4, pp. 177–183.) The motion of an electron in an axially symmetric magnetic field under the action of an external torque due to an r.f. field is analysed, and the oscillations about the equilibrium orbit investigated. The transition from betatron to synchrotron motion is examined and the condition established for the 'locking in' of the electrons to synchronous driving by the r.f. field. Stable synchrotron operation is shown to be quite practicable. See also 3440 of 1946 (Dennison & Berlin).

621.384.032.21 **495**

R.F. Heating Cyclotron Filaments.—A. E. Hayes, Jr. (*Phys. Rev.*, 1st/15th Aug. 1946, Vol. 70, Nos. 3/4, p. 220.) The r.f. generator which feeds the filament of a cyclotron is usually remote (for ease of adjustment), and so requires a long transmission line between the oscillator and the ion source. The advantages of using a mean oscillator frequency which makes the line one quarter wavelength long are explained.

621.385.833 + 537.533.72 **496**

The Electron Microscope.—G. Dupouy. (*Metal Treatm.*, Autumn 1946, Vol. 13, No. 47, pp. 153–168, 205.) Description of its theory, construction, and operation, and some of the results obtained by its application to the study of metals.

621.396.998 : 629.135 **497**

Drones — Prelude to " Push-Button " Warfare ?—O. Read. (*Radio News*, Oct. 1946, Vol. 36, No. 4, pp. 25–29..104.) A brief account of the use of automatically controlled aircraft for taking observations during atom-bomb tests. The aircraft were controlled by radio from piloted aircraft.

621.397.26 : 343.977.33 **498**

Transmission of Finger-Prints by Radio.—(*Nature, Lond.*, 12th Oct. 1946, Vol. 158, No. 4015, pp. 525–526.) Note of some recent applications of facsimile to police work described in pamphlet by F. R. Cherrill.

771.448.1 **499**

Photographic Use of Electrical Discharge Flashtubes.—H. E. Edgerton. (*J. opt. Soc. Amer.*, July 1946, Vol. 36, No. 7, pp. 390–399.)

PROPAGATION OF WAVES

538.566 **500**

The Group Velocity in a Crystal Lattice. — Mandelstam. (*See* 397.)

551.501.7 **501**

Measurements of Refractive Index Gradient.— Westwater. (*See* 413.)

551.510.535 : 523.78 **502**

Eclipse-Effects in F_2-Layer of the Ionosphere.—H. W. Wells & A. H. Shapley. (*Terr. Magn. atmos. Elect.*, Sept. 1946, Vol. 51, No. 3, pp. 401–409.) A study of ionospheric observations at College, Watheroo and Huancayo during the partial solar eclipses of February and August 1943 and January 1944. F_2-layer ionization was in all cases subnormal before and after the eclipse, indicating that radiations from beyond the limb of the sun may contribute to the ionization of the region. Estimated values of the recombination coefficient for the F_2 layer for these eclipses lie between 10^{-9} and 2×10^{-10}. At Huancayo during the 1944 eclipse the F_2 layer rose to great heights at a rate of about 200 km per hour, and a new F-region stratification developed at normal heights. See also 503 below.

551.510.535 : 523.78 **503**

Effects on the Ionosphere at Huancayo, Peru, of the Solar Eclipse, January 25, 1944.—P. G. Ledig, M. W. Jones, A. A. Giesecke & E. J. Chernosky. (*Terr. Magn. atmos. Elect.*, Sept. 1946, Vol. 51, No. 3, pp. 411–418.) A detailed account of the results for the E, F_1 and F_2 layers is given, together with simultaneous signal intensities observed on a 15-Mc/s transmission over a distance of 3 500 miles. Minima in ion density were recorded for the E and F_1 layers near the time of maximum eclipse, with a delayed effect in the case of the F_2 layer. An effect on F_2-layer ion-density, possibly due to a corpuscular eclipse, is also described. See also 502 above.

551.594.51 **504**

The Auroral Luminosity-Curve.—Harang. (*See* 417.)

621.396.11 : 523 [.7 + .854 **505**

Extra-Tropospheric Influences on Ultra- Short-Wave Propagation.—Appleton. (*See* 402.)

621.396.11 : 621.392 **506**

Some Questions connected with the Excitation and Propagation of Electromagnetic Waves in Tubes.—L. Mandelstam. (*Zh. eksp. teor. Fiz.*, 1945, Vol. 15, No. 9, pp. 461–470. In Russian.) A new analytical method is proposed. The excitation of electromagnetic waves in free space is considered first. It is assumed that in the plane $z = 0$ there is a double layer of electric charges, *i.e.* a plane layer of dipoles with their axes parallel to the z-axis. A formula (1) is quoted determining the z-component Π of the Hertz vector, and is transformed into formula (4). The latter formula is applied to the case of a linear belt of dipoles of radius r and constant linear dipole density m. A formula (5) determining Π for this case is derived. If the belt is reduced to a point the well-known Sommerfeld integral is obtained.

A circular tube of infinite length and with ideally conducting walls is then considered. The exciter is assumed to be a plane double electric layer, *i.e.* a layer of electric moments lying in the plane $z = 0$ and directed along the z-axis of the tube. A formula (11) determining Π for this case is derived together with formula (15) for the case of a point dipole on the axis of the tube. Methods for determining E and H from these formulae are indicated. Formula (15) is analysed, and various peculiarities are pointed out. The excitation by a point dipole displaced from the z-axis is also considered.

The case of ' magnetic ' excitation of waves in tubes is discussed next. This type of excitation can be achieved by introducing into the tube in the plane $z = 0$ a loop carrying current and having a figure-of-eight or more complicated shape. Methods for determining the ' magnetic ' Hertz vector Π^* for this case, as well as E and H, are suggested.

The attenuation of the waves in tubes due to losses in the walls is considered and relationships between the various quantities involved are established.

Finally, it is shown that the problem considered can be reduced to the same boundary conditions as those of a vibrating diaphragm. It is therefore possible to make use of Courant's theorems for obtaining additional information such as the effect of varying the shape of the tube cross-section or introducing a conductor along the axis of the tube.

621.396.11.029.64 **507**

Perturbation Theory of the Normal Modes for an Exponential M-Curve in Non-Standard Propagation of Microwaves.—C. L. Pekeris. (*J. appl. Phys.*, Aug. 1946, Vol. 17, No. 8, pp. 678–684.) The region beyond the horizon is mainly considered, for cases in which the deviation of the M-curve from the standard is an exponential function of the height expressed in natural units (M denotes modified refractive index). Within its region of convergence the theory is applicable to the most general type of M-curve, including elevated ducts. " The region of practical convergence ranges from highly substandard conditions down to cases where the decrement is a fraction of the standard value." The procedure is to express the height gain function of any mode in the non-standard case as a linear combination of the height gain functions of all the modes in the standard case. The success of this depends on being able to evaluate quantities $\beta_{nm}(\lambda)$ which can be expressed as infinite integrals involving products of the height gain functions of the standard case.

621.396.65 **508**

Hertzian Cable [radio links in multichannel telephony circuits].—Clavier & Phélizon. (*See* 540.)

621.396.81.029.6 : 551.43 **509**

An Experimental Investigation on the Propagation of Radio Waves over Bare Ridges in the Wavelength Range 10 cm to 10 m (Frequencies 30 to 3 000 Mc/s).—J. S. McPetrie & L. H. Ford. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 108–109.) For horizontally-polarized transmission over an approximately cylindrical hill of radius 11 000 ft, experimental results are in good agreement with the rate of attenuation calculated by Domb and Pryce (assuming a ground reflection coefficient of −1) at wavelengths 9.2 cm, 25 cm, and 56 cm.

For a cylindrical ridge of radius 1 250 ft, wavelength 2.25 m, horizontal polarization gives results agreeing with the calculations of Domb and Pryce for a sphere of 1 250 ft radius, but vertical polarization shows a lower rate of attenuation, and signal strength less out of the shadow and greater in the shadow. Experiments were also made at 9.2, 25, 56 cm and 11.15 m; at 11.15 m attenuation was less with vertical than with horizontal polarization, otherwise results were the same on the two polarizations. Summary of an I.E.E. Radiolocation Convention paper.

621.396.81.029.63/.64 **510**

Theoretical Estimation of Field Strength.—J. M. C. Scott. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 104–105.) The reflecting power of a target for decimetre or centimetre waves can be satisfactorily expressed in terms of a 'linear scattering constant' L which is roughly 2 m to 4 m for the head-on aspect and 1 m for other aspects; received power is proportional to transmitted power × $L^2\lambda^{-2}$

Ray-theory interference patterns obtained by geometrical optics are satisfactory at short ranges or great heights. For long ranges and low heights, wave theory must be used, especially when some of the power emitted by the transmitter becomes trapped in an atmospheric layer. This effect can set in below a certain wavelength depending on the meteorological situation. According to the wave theory there is an infinite series of characteristic waves (or 'normal modes') of which, for any particular meteorological situation, some may travel horizontally with little attenuation while the rest are rapidly attenuated. The attenuation constants and height gains can be calculated numerically from the wave equation; tables for various types of atmospheric model are available.

If the wavelength is small compared to that for energy trapping, ray-tracing methods can be used; the rays in a heterogeneous atmosphere with a nonlinear structure form a series of envelopes or caustic curves. Calculations are laborious.

Calculations have also recently been made of the reflection coefficient of an elevated inversion layer at oblique incidence.

621.396.81.029.64 : 551.43 **511**

Some Experiments on the Propagation over Land of Radiation of 9.2 cm Wavelength, especially on the Effect of Obstacles.—J. S. McPetrie & L. H. Ford. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 107–108.) A signal of known power was transmitted, and the received signal strength measured with a calibrated receiver. Short range results on a level site (up to 1 km) agreed with the inverse square law and a ground reflection coefficient of −1, but this was not true for an undulating site. It was found that a large tree should be regarded as an opaque body. A dense screen of leafless trees was comparable to a solid obstacle over which Fresnel diffraction took place. Screens of trees in full leaf, even only two or three trees thick, formed an opaque obstacle. Most buildings must be regarded as opaque, diffracting objects. Summary of an I.E.E. Radiolocation Convention paper.

621.396.81.029.64 **512**

A Study of Some of the Factors influencing Microwave Propagation.—B. J. Starnecki. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 106–107.) An analysis of the experimental results described in Megaw's paper (518 below). For a slightly non-optical link propagation can be regarded as normal. On the other hand, for a 60-mile link 2.3 times optical range, signal levels are mainly much higher than can be expected from refraction-diffraction formulae. Only in about 15% of the cases was there clear meteorological evidence of the formation of a radio duct of width greater than 50 ft, but comparison of simultaneous signal levels on 3 cm and 9 cm suggested that between 50% and 70% of the results on this link were due to ducts with heights between 20 ft and 40 ft, the remainder being due to normal propagation. The signal level was above 'free space' level for about 20% of the whole 5-month period. When the receiver was replaced by one at 20 ft, the results still agreed well with those expected for duct widths between 20 and 40 ft. For the 200-mile link, 70% of the observed signal levels can only be explained by the presence of ducts.

Summary of an I.E.E. Radiolocation Convention paper.

621.396.812 + 538.566.3 **513**

Observations on the Interaction of Waves in the Ionosphere, in relation to the Gyrofrequency.—M. Cutolo, M. Carlevaro & M. Gherghi. (*Alta Frequenza*, June 1946, Vol. 15, No. 2, pp. 111–117.) A description of experiments carried out in Italy in 1946 on the Luxemburg (cross-modulation) effect. Observations on a number of stations, one of which was varied in frequency, confirmed V. A. Bailey's theoretical prediction that the degree of cross-modulation is greatly increased if the frequency of the disturbing station is in the neighbourhood of the gyrofrequency. See 2437 of 1937 and back references.

621.396.812 + 621.396.11 **514**

The Importance of Theory in the Development and Understanding of Radar Propagation.—T. L. Eckersley. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 103–104.) The phase integral theory was originally applied to the problem of diffraction round an imperfectly conducting earth, and was later extended to include the effect of atmospheric refraction in a particularly easy and significant way. Ray methods are essentially inaccurate and must be replaced by correct wave theory. To use refraction in radar work a more thoroughly satisfactory meteorological theory is required than yet exists. Sudden discontinuities of refractive index at considerable heights, due for example to subsidence inversions, could cause long-distance propagation by the internal reflection of characteristic waves. The radio problem is perfectly definite if the radio refractive index is known everywhere as a function of height, though the solution may be difficult in practice.

Carefully controlled experiment could help to decide the physical basis of theories for problems as yet imperfectly understood, such as turbulence and attenuation due to scattering.

621.396.812.029.64 **515**

The Attenuation of Centimetre Radio Waves and the Echo Intensities resulting from Atmospheric Phenomena.—J. W. Ryde. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 101–103.) The effects to be considered are quite negligible for wavelengths above the centimetre band, but in general increase rapidly as wavelength decreases. Of atmospheric gases, oxygen produces an attenuation between 0.01 and 0.02 db/km throughout the centimetre band, while water produces a very small attenuation at 10 cm rising to about 0.2 db/km near 1 cm; other gases can be neglected.

For fogs and fine droplet clouds, attenuation depends only on the total mass of liquid per unit volume; a table gives attenuation approximately in terms of visual range in such clouds.

For rain, average attenuation in db/km is approximately proportional to precipitation rate in the centimetre band; the constant of proportionality depends upon temperature and wavelength.

The attenuation produced by hail is small compared to that for rain except for wavelengths near 1 cm.

Echo intensities from atmospheric fogs and fine droplet clouds are very weak: even moderate rain, however, can produce an echo intensity (for which a formula is given) comparable with that from an aircraft.

621.396.812.029.64 **516**

Elements of Radio Meteorology: How Weather and Climate cause Unorthodox Radar Vision beyond the Geometrical Horizon.—H. G. Booker. (*J. Instn elect. Engrs*, Part I, Oct. 1946, Vol. 93, No. 70, pp. 460–462 [summary] and Part IIIA, 1946, Vol 93, No. 1, pp. 69–78 [full version].) Radar receivers are frequently able to 'see' round the curved surface of the earth owing to radio refraction in the lower atmosphere. The phenomenon is most marked when both radar equipment and target are close to the earth. In its simplest form it involves an atmospheric waveguide, or radio duct, close to the earth's surface; within the duct the curvature of a radio ray emanating horizontally from a transmitter would exceed that of the earth. The longer the wavelength, the greater must be the width of this radio duct for efficient guiding to take place. In the British Isles, a typical duct involving important conditions of superrefraction would be one extending from the earth's surface up to 100 ft. This can be an efficient waveguide for centimetre wavelengths, but at metre wavelengths it would merely produce an abnormal reduction of horizontal attenuation beyond the horizon. In other parts of the world, such as India during the hot season, duct widths of 1 000 ft or more can occur; a case is cited of a 1½-metre radar near Bombay which had at various times 'seen' different points on the Arabian coastline up to 1 500 miles away.

The most important meteorological conditions for superrefraction are that the upper air, at a height of a few thousand feet, should be exceptionally warm and dry in comparison with the earth's surface; the associated unusual gradients of temperature and humidity are the cause of downward superrefraction. In order to allow for the normal drop of temperature and humidity with height in a well-mixed air mass, it is advisable to use 'potential temperature' and 'specific humidity' as the fundamental parameters. Stormy and turbulent conditions, and bad weather in general, produce a well-mixed air mass near the ground with little vertical change of potential temperature or specific humidity and therefore with orthodox propagation. Superrefraction occurs when upper-air potential temperature exceeds appreciably that at the surface, while upper-air specific humidity falls short of that of the surface. This is essentially a fine-weather phenomenon, and therefore tends to be most intense in tropical (but not equatorial) climates, inland at night in fine, warm weather, and when warm, dry air over land drifts out over relatively cool sea. At present, only qualitative forecasting of superrefraction is possible.

621.396.812.029.64 **517**

A Preliminary Investigation of Radio Transmission Conditions over Land and on Centimetre Wavelengths.—R. L. Smith-Rose. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 98–100.) A study of the radio-meteorological aspects of the experiments described in Megaw's paper (518 below). In overland transmission along a 38-mile path, mean hourly intensity was sometimes steady to within 1 or 2 db all day, while on other occasions there was a marked diurnal variation from a minimum in the early morning to a peak near midnight, associated with fine, clear nights. If fog occurred, the signal strength would drop to a well-marked minimum, and rise to the normal daily value when the fog cleared. For radio communication links at centimetre wavelengths on an oversea non-optical path, it is advantageous to place the stations as high as practicable if the maximum reliability of service is required.

During good weather, signal level is usually high and somewhat variable; low signal corresponds to poor visibility; a decrease followed by an increase is associated with the passage of a front. Special meteorological observations by aircraft between 50 ft and 1 500 ft were made from which could be calculated the radio signal strength to be expected; the agreement with the observed values is very good (Fig. 3).

621.396.812.029.64 **518**

Experimental Studies of the Propagation of Very Short Radio Waves.—E. C. S. Megaw. (*J. Instn elect. Engrs*, Part I, Oct. 1946, Vol. 93, No. 70, pp. 462–463 [summary] and Part IIIA, 1946, Vol. 93, No. 1, pp. 79–97 [full version].) "The main experimental programme described consisted of measurements of 3-cm, 9-cm, and 3½-m waves over sea paths 57 and 200 miles long; and of 9-cm waves over a single 38-mile land path. The measurements were continuous over some of these paths for periods between two and three years; and, particularly as regards detailed correlation with meteorological measurements, the work is still in progress."

From preliminary studies it is concluded that for optical paths (up to about 20 miles) over sea the observed field differs little from that calculated from a standard atmosphere; over longer paths with correspondingly greater heights, variability increases; over very long optical paths variability increases still further; fades of 30 db lasting a few minutes are not uncommon while fades of 10 db lasting an hour may occur in fine weather. Atmospheric absorption is unimportant at 9 cm over a path of 100 miles. Short-period fading on 9.2 cm is quite different from that on 10.0 cm though general trends are similar.

For optical paths over land up to 50 miles results are similar to those for sea except for unexpectedly low, steady levels over some short paths, possibly due to interference. Variations are greatest at night. For non-optical paths over sea, the minimum signal level (when measurable) was usually close to that calculated for a standard atmosphere; the maximum approaches but rarely exceeds the level corresponding to free-space propagation. In anticyclonic weather with the wind mainly off-shore, there tends to be a diurnal maximum in the afternoon and evening, and a minimum in the early morning. For non-optical paths over land results are similar to those for sea but less definite owing to geometrical uncertainties concerning the path. High diurnal levels occur during radiation-inversion nights, but overcast skies or wind suppress this variation.

Change of polarization had little effect; changes in bearing exceeding the measurement accuracy of about 1° were hardly ever observed.

See also 517 above.

RECEPTION

621.396.62 **519**

Design and Application of Squelch Circuits.—F. Delanoy. (*Radio, N.Y.*, Sept. 1946, Vol. 30, No. 9, pp. 11–13..30.) Two main classes of squelch circuits are considered, namely, that in which a control voltage related to the amplitude of the input carrier immobilizes the receiver *via* an electromagnetic relay, and that in which the action is fully electronic. Examples from each class are briefly described. See also 520 below.

621.396.62 **520**

Notes on the Design of Squelch Circuits.—F. Delanoy. (*Radio, N.Y.*, Oct. 1946, Vol. 30, No. 10, pp. 12–14.) Descriptions of various interchannel noise-suppression circuits for f.m. receivers, including blocked audio-frequency circuits, reflected impedance squelch circuits, and squelch oscillators. The severe distortion due to signal levels which partially operate the squelch tube but do not suppress reception completely can be overcome by using an adjustable threshold control, or a squelch disabling switch. See also 519 above.

621.396.62 : 621.317.755 **521**

Panadaptor.—Panoramic Radio Corporation. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, p. 285.) An instrument for panoramic reception, which may be attached to communications receivers with i.f. of 450–470 kc/s. The bandwidth is adjustable from 200 kc/s down to zero. Many applications are indicated, including three-station communication, air traffic control when an aircraft transmitter is off frequency, detection of frequency shift, and study of signal characteristics.

621.396.621 **522**

Designing the Postwar Receiver.—B. Halligan & C. Read. (*Radio News*, Oct. 1946, Vol. 36, No. 4, pp. 50–51..110.) The receiver described provides a.m. or c.w. reception from 540 kc/s to 110 Mc/s and f.m. reception from 27 Mc/s to 110 Mc/s. This wide coverage is obtained by the use of a new r.f. 'split-stator' circuit. Other features of the receiver are described briefly.

621.396.621.029.62 **523**

Super-Regenerative 2 Meter Receiver.—J. A. Kirk. (*Radio News*, Oct. 1946, Vol. 36, No. 4, pp. 30–31..108.) General remarks on the performance of superregenerative receivers and details of a suitable circuit for such a receiver operating at v.h.f.

621.396.621.54 **524**

Zero Tracking Error in Superheterodynes.—A. Bloch. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, pp. 328–329.) Describes a pair of LC circuits which give zero tracking error over the entire tuning range. This is obtained by simultaneous variation of L and C such that the ratio L/C remains constant. A first-order deviation from this constant ratio leads only to second-order tracking errors. The treatment is theoretical, but the principle has been successfully applied in a practical case.

621.396.813 : 534.78 **525**

Effects of Amplitude Distortion upon the Intelligibility of Speech.—Licklider. (*See* 338.)

621.396.822 : 621.385.032.21 **526**

Radio Design Worksheet No. 52: A.C. Filament Noise.—(*Radio, N.Y.*, Sept. 1946, Vol. 30, No. 9, p. 20.) The nature of the interfering voltages introduced into the anode current of a directly heated valve operated with an a.c. filament supply is considered.

STATIONS AND COMMUNICATION SYSTEMS

621.394/.396].7.029.58 **527**

Radio Stations near Toulouse.—C. Cardot & M. Bergeron. (*Onde élect.*, Aug./Sept. 1946, Vol. 26, Nos. 233/234, pp. 318–330.) Describes a system of radio stations planned as a Government communication headquarters and partially constructed despite the German occupation, operating in the wavelength range 13–60 m.

621.394.441 **528**

Performance Characteristics of Various Carrier Telegraph Methods.—T. A. Jones & K. W. Pfleger. (*Bell Syst. tech. J.*, July 1946, Vol. 25, No. 3, pp. 483–531.) On-off, single sideband, and one- and two-source frequency shift methods were considered, to determine their relative advantages from the standpoints of signal speed, sensitivity to level change, carrier frequency drift, interchannel interference, and line noise. For stable, quiet circuits the on-off system is the most suitable, but the other systems may result in improvement under certain adverse conditions. Numerous graphical results are summarized in tabular form.

621.395/.396].7 **529**

R.M.S. Queen Elizabeth.—(*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 357–358.) A general description of equipment carried, which includes: a ship-to-shore radio-telephone system; lifeboat radio equipment; a low power system for communication between pilot and tugs when docking; Gee, Loran and other navigational aids; and a public address system.

621.395(7) **530**

Telecommunications Developments.—(*Electrician*, 4th Oct. 1946, Vol. 137, No. 3566, pp. 935–936.) Summary of a report on the visit of British Post Office officials to North America. Recent developments there include a new automatic telephone system using the 'cross bar' switch; equipment for use on coaxial cables; mobile telephones for motor cars; temporary splitting of trunk circuits; and an automatic (trunk-call) ticketing system. Experiments were in progress to develop telephones for communication between train driver and guard, and for shunting.

621.395.44 **531**

New Single Channel Carrier Frequency Telephone System for Open-Wire Lines.—E. Eklund. (*Ericsson Rev.*, 1946, Vol. 23, No. 3, pp. 259–266.) A new system ZAF11 has been developed replacing the older ZL400 (described in *Ericsson Rev.*, 1936, No. 2). The dimensions and weight of the new system are considerably reduced. The range is 700 km without intermediate repeaters when using an open-wire circuit of copper wires 3 mm in diameter.

621.396 : 629.13 **532**

Aviation Radio Equipment.—(*See* 421.)

621.396.004.67 : 629.135 **533**

Airline Radio Service.—E. D. Padgett. (*Radio Craft*, Oct. 1946, Vol. 18, No. 1, pp. 20–21..53.) A table of common faults, probable causes and remedies is given, together with miscellaneous suggestions for preventive maintenance.

621.396.1 : 621.396.933.1/.4 **534**

International Conference on Air Routes over Europe and the Mediterranean (Paris, April/May 1946).—Dalle. (*Onde élect.*, July 1946, Vol. 26, No. 232, pp. 299–300.) Among the subjects discussed were the provision of various aerodrome and ground facilities, and the allocation of frequencies for telecommunications, navigation systems and distress signals.

621.396.33.029.3.083.7 : 656.2 **535**

Train Position Indicator.—E. A. Dahl. (*Electronics*, Oct. 1946, Vol. 19, No. 10, pp. 122–124.) Outline description of an audio-frequency system in which the times of arrival of trains at chosen points and departures therefrom are recorded on paper in a remote signal-box.

621.396.4 : 551.509 **536**

AACS Radioteletype Weather Transmission System.—F. V. Long. (*Communications*, Sept. 1946, Vol. 26, No. 9, pp. 16..55.) The frequency-shift system as used by the U.S.A.A.F. for transmission of weather reports is illustrated with the aid of block diagrams. Methods used during the first weather broadcasts by radioteletype, with intercept receiving installations at smaller airfields and the operational difficulties of simplex systems are described. An analysis is made of improved results obtained from full duplex operation.

621.396.41 : 621.398 **537**

Test shows how Wire-Carrier and Beamed Radio direct Signals and Train Operation.—(*Telegr. Teleph. Age*, Oct. 1946, Vol. 64, No. 10, pp. 5–6..30.) Demonstration of the application of existing wire-carrier and centimetre-wave multiplex communication circuits to the operation of signals and points of a railway system at very long ranges from a control signal box. Signals from the control box were sent by a roundabout route about 900 miles long to operate signals and points some 60 miles distant. The significance of the tests is briefly discussed.

621.396.44 : 621.315.211.9.052.63 **538**

Carrier-Current Communication on Air and Paper Insulated Cables.—Lucantonio. (*See* 352.)

621.396.619 **539**

High Efficiency Modulating Method.—J. Beckwith. (*Radio, N.Y.*, Oct. 1946, Vol. 30, No. 10, pp. 9–11..32.) Amplitude modulation is achieved by shifting the phase of the carrier frequency at an audio-frequency rate and combining the phase-shifted carrier with the unmodulated carrier, producing a resultant varying in amplitude as the phase is shifted. The magnitude and spread of the phase-modulation side-bands (which accompany the amplitude-modulation side-bands in the radiated signal) are not excessive by F.C.C. regulations. Circuit diagrams are given for a 4.5-kW transmitter.

621.396.65 **540**

Hertzian Cable [radio links in multichannel telephony circuits].—A. G. Clavier & G. Phélizon. (*Onde élect.*, Aug./Sept. 1946, Vol. 26, Nos. 233/234, pp. 331–344.) Discussion of the application of frequency-modulated centimetre wave radio links to multichannel telephony circuits, followed by a general description of a twelve-channel link about 10 miles long between Paris and Montmorency (See also 3743 of 1946). In this circuit, transmission in one direction is horizontally polarized on a wavelength of 9 cm, with vertical polarization on 10 cm in the reverse sense. Separate horns having beam widths of the order of 10° are used for transmission and reception. The radio link is designed for direct insertion in a carrier telephony circuit, the twelve speech channels occupying the frequency band 12–60 kc/s. At the transmitter a velocity-modulated oscillator developing about 30 W of r.f. power is used. The speech-modulated carriers are used for frequency modulation of the oscillator which has a sensibly uniform characteristic for a frequency range of about 1 Mc/s. Superheterodyne receivers having positive grid oscillators and diode mixers are used. Extensive application is made of negative feedback technique in transmitters and receivers to maintain linearity and stability of operation; the principles involved are discussed in some detail. The possible future development of radio links for transmission of wide-band intelligence is outlined; the attenuating effects of constituents of the atmosphere at centimetre wavelengths are briefly mentioned.

621.396.712.004.5 **541**

Preventive Maintenance for Broadcast Stations: Part 4.—C. H. Singer. (*Communications*, Sept. 1946, Vol. 26, No. 9, pp. 36 . . 38.) A discussion of "seven basic preventive maintenance procedures ... feel, inspect, tighten, clean, adjust, lubricate and measure". For part 3 see 3423 of 1946.

621.396.712 **542**

Radio Stations. [Book Notice]—Federal Communications Commission, 26 pp., 10c. (*U.S. Govt. Publ.*, July 1946, No. 618, p. 777.) Standards of good engineering practice concerning f.m. broadcast stations, revised to 9th Jan. 1946.

SUBSIDIARY APPARATUS

621–526 **543**

Dimensionless Analysis of Servomechanisms by Electrical Analogy.—S. W. Herwald & G. D. McCann. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 636–639.)

621.314.6+621.319.4+621.383] : 669.018 **544**

Light Alloys in Metal Rectifiers, Photocells and Condensers.—Continuing the series in various issues of *Light Metals*. For previous parts see 3768 of 1946.

(vi) Dec. 1944, Vol 7, No. 83, pp. 565–566. Begins a detailed consideration of the theory and practice of electrolytic capacitors.

(vii) Jan. 1945, Vol. 8, No. 84, pp. 25–41. An exhaustive discussion on the theory, practice and operation of the electrolytic capacitor. In particular the properties of the aluminium-oxide film are considered.

(viii) Feb. 1945, Vol. 8, No. 85, pp. 87–100. Consideration is given to the theory and practice of the formation of electrolytes for electrolytic capacitors, and to their design and production, with typical examples.

(ix) April 1945, Vol. 8, No. 87, pp. 193–202. Discussion on the theory and practice of electrolytic capacitors.

(x) May 1945, Vol. 8, No. 88, pp. 246–254. Concludes (ix) and considers in detail fixed paper capacitors.

(xi) June 1945, Vol. 8, No. 89, pp. 292–304. Fixed paper capacitors, and the use of tin and aluminium foils, are discussed.

To be continued.

621.317.755.087.5 **545**

Recording of Transients.—W. Nethercot. (*Elect. Times*, 14th Nov. 1946, Vol. 110, No. 2873, pp. 648–651.) For all except the highest writing speeds a sealed-off cathode-ray oscillograph with an accelerating voltage not less than 5 kV and a blue-violet screen may be used. A camera with an F 1.0, 2-inch focus lens operating with an object/image ratio of 4 or 5 to 1 and using a high speed orthochromatic film is recommended. Thirteen prints with writing speeds up to 20 000 km/sec are shown.

621.318.42 **546**

Saturable Choke Controlled Rectifiers.—H. S. Double. (*P.O. elect. Engrs' J.*, Oct. 1946, Vol. 39, Part 3, pp. 110–113.) Notes on the basic principles and capabilities of this form of control for d.c. power supplies.

621.352.7 **547**

Miniature Dry Cell.—(*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, pp. 286–287.) A dry cell having a high ratio of capacity to volume with long life has been developed for tropical use by P. R. Mallory & Co. Within its rating the cell has an ampere-hour capacity substantially independent of rate of discharge. Dimensions of the cell are 1 inch in diameter and ⅝ inch high.

621.383 **548**

Various Papers on Electron Multipliers.—(*See* 577/578.)

621.384 **549**

Various Papers on Electron Accelerators.—(*See* 494/495.)

621.395.631.4 **550**

Recent Design of a Small Telephone Magneto.—D. S. Smith. (*Canad. J. Res.*, Sept. 1946, Vol. 24, Sec. F, No. 5, pp. 406–408.) " An example is given of the product obtained by applying modern methods in permanent magnet design to the problem of constructing a hand driven magneto of about flashlight battery size."

621.791.76 **551**

Miniature Spot-Welding Tools.—R. W. Hallows. (*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 373–374.) The tool, which is made by Siemens-Halske A.-G., is 10 inches long and 1 inch in diameter: the smaller model can be used for wire up to 0.8 mm diameter while the larger is for any joint whose surface area does not greatly exceed 10 sq. mm. Mains supply at 110 V or 250 V (50 c/s) can be used: the welding voltage does not exceed 35 V.

TELEVISION AND PHOTOTELEGRAPHY

621.396.8 : 621.397.26 **552**

Television Link Tests in Southern California.—P. B. Wright. (*Communications*, Oct. 1946, Vol. 26, No. 10, pp. 15, 55.) Report of experimental f.m. television transmission and reception over 17.2-mile line-of-sight paths between Mt Wilson (5 700 ft) and Hollywood. In one case metallic lenses 5½ ft by 7½ ft with a power gain of about 35 db per lens were used, in the other, 57-inch parabolic reflector-type radiators, with gain 3 to 4 db less. Each lens gave an effective directed power of 1 200 W over that of an omnidirectional point source. This gives a sufficient margin even under severe fading conditions. The frequency bands were 4 416–4 420 Mc/s (reflectors) and 4 376–4 380 Mc/s (lenses).

621.397.262 **553**

Approximate Method of Calculating Reflections in Television Transmission.—D. A. Bell. (*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 352–354.) An examination of the effects of " carrier frequency, size of reflecting obstacle, distance of reflecting obstacle from transmitter and from receiver, and degree of definition of the television picture, on the incidence of reflection troubles in television reception. The diffraction problem is treated by a simple mathematical approximation which has been previously used in optics."

621.397.5 : 532.62 **554**

Oil-Film Television.—(*Radio Craft*, Oct. 1946, Vol. 18, No. 1, pp. 22–23.) An electron gun, modulated by incoming signals, scans 50 times a second the surface of a film of special liquid about 0.1 mm thick and deforms it in such a way that light from an arc lamp is allowed to pass on to a projection screen. The film rests on a glass plate, which is illuminated from below by focusing the arc lamp beam with mirrors and a lens. The deformation is increased by placing a charged electrode near the film and by charging the film uniformly with a second electron gun. The glass plate rotates uniformly, carrying the film, and provision is made for the film to be smoothed ready for further use.

621.397.6 **555**

U.S. Television Gear.—(*Wireless World*, Nov. 1946, Vol. 52, No. 11, p. 380.) Description of an image orthicon camera developed by R. C. A. with a revolving lens turret, a device for rapid changing of lenses and a wide-band microwave relay link.

621.397.6 **556**

Surveying Recent Television Advances.—R. R. Batcher. (*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, pp. 46–48..106.) New cameras include the image-orthicon with a telephoto lens system while the iconoscope and the orthicon tubes have been improved. New valves are now used in transmitters and receivers and relay systems involving airborne apparatus are being investigated. Mirror and lens systems are being used for large-screen projection and experiments with skiatrons are in progress. American television-frequency data are tabulated.

621.397.62 **557**

Rebuilding a Televiser.—N. Chalfin. (*Radio Craft*, Sept. 1946, Vol. 17, No. 12, pp. 832..881.) Describes methods of modernizing pre-war television receivers; a circuit diagram indicates the changes necessary.

621.397.621 **558**

Deflector Coil Coupling.—W. T. Cocking. (*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 360–363.) A straightforward semi-graphical method is described whereby curvature of valve characteristics may be used to compensate the nonlinear characteristics of the deflector coil to produce a linear saw-tooth output. A numerical example is fully discussed. See also 272 of January (Cocking).

621.397.74 **559**

Multi-Outlet T-V [television].—(*Electronic Industr.*, Oct. 1946, Vol. 5, No. 10, p. 57.) Describes a system for providing a large number of television receivers with choice of programme. The programmes are received by suitable aerial systems and passed through single-valve amplifiers into a common concentric line. Attenuating pads at each receiver prevent mutual interference.

TRANSMISSION

621.396.61 : 621.396.619.018.41 **560**

Direct F.M. Transmitters : Part 9.—N. Marchand. (*Communications*, Sept. 1946, Vol 26, No. 9, pp. 26–29..35.) Design principles are considered with the aid of block and circuit diagrams. Input capacitance, phase discriminator exciter and pulse control exciter units are discussed. For part 8 see 3452 of 1946.

621.396.61 : 621.396.619.018.41 **561**

Mobile F.M. Transmitters : Part 10.—N. Marchand. (*Communications*, Oct. 1946, Vol. 26, No. 10, p. 30.) The advantages of f.m. are briefly stated and a 25–50-W mobile transmitter on 30–44 Mc/s is described. For earlier parts see 560 above and back references.

621.396.61 : 621.396.721 **562**

An Auxiliary Radio Transmitter for Broadcast Service.—C. A. Cullinan. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1946, Vol. 7, No. 9, pp. 4–11. Discussion, pp. 11–12.) Designed and constructed with available war-time material, the circuit consists of a crystal-controlled oscillator, a single r.f. buffer stage, and a class-C amplifier with a class-B modulator (anode modulation). The carrier power was 125–150 W, capable of 100% modulation. The audio-frequency response was "within 0.5 db from 40–10 000 c/s and within 2 db down to 30 c/s". Distortion and noise were virtually non-existent. A 56-ft vertical radiator was used, and the transmitter could be in operation in less than a minute.

621.396.61 : 621.396.97 **563**

Experimental 88 to 108-Mc/s 250-Watt F. M. Broadcast Transmitter.—J. H. Martin. (*Communications*, Sept. 1946, Vol. 26, No. 9, pp. 22–24..45.) Main features include the Armstrong phase-shift system modulator, with the centre carrier frequency directly controlled by crystal for stability reasons. The complicated modulator system is explained fully. The power amplifier comprises 4-125A type tetrodes, neutralized by tuning the screen inductance to earth by means of a split-stator capacitor.

621.396.61 [(43) + (44) + (73)] " 1939/45 " **564**

Transmitting Equipment of the French, German and American Armies.—R. Besson. (*Toute la Radio*, Jan. 1946, Vol. 13, No. 102, pp. 31–35.) An account of the special features of various types of equipment handled by a French technician between 1939 and 1945. The great tactical superiority of the f.m. apparatus used by the Americans is stressed.

621.396.61.029.56/.58 **565**

Top-Band Two Transmitter.—J. N. Walker. (*R.S.G.B. Bull.*, Nov. 1946, Vol 22, No. 5, pp. 66–69, 75.) Description of a self-contained low power transmitter for use on 1.8 Mc/s, 3.5 Mc/s and also on 7.5 Mc/s at somewhat reduced efficiency. Constructional details, a circuit diagram, and a list of components are given.

621.396.61.029.62 **566**

A 100-kW Portable Radar Transmitter.—H. L. Lawrence. (*Communications*, Sept. 1946, Vol. 26, No. 9, pp. 30..33.) The unit contains the r.f. power-oscillator modulator, high voltage power supply, and a wavemeter for frequency measurement. Frequency range is 225 to 250 Mc/s; mean power output, 40 W; pulse shape, half sine wave; pulse length, 1.6 μs and recurrence frequency, 600 c/s. Primary power is obtained from a petrol-driven generator. Special air-cooled oscillator valves 4C27, are used in a grounded plate circuit, and the frequency is controlled by a variable inductance in the grid circuit. The cathode is tuned by a parallel wire transmission line, to which the antenna is directly coupled. "The r.f. oscillator is plate-modulated by a gas-discharge tube pulse-forming circuit."

621.396.619.018.41.029.6 **567**

Über Frequenzmodulatoren für Ultrahochfrequenz. [Book Review]—G. Weber. Gebr. Leemann, Zürich, 95 pp., Swiss Fr. 9. (*Wireless Engr*, Dec. 1946, Vol. 23, No. 279, p. 340.) Deals with the difficulties of applying frequency modulation to transmitters working at frequencies of 100 to 600 Mc/s.

VALVES AND THERMIONICS.

537.533.7 **568**

Electron-Optical Properties of Emission Systems.—L. A. Artsimovich. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 6, pp. 313–329. In

Russian.) Apparatus in which an electron-optical image of an object emitting slow electrons is obtained can be divided into three classes according to whether the image is (*a*) greatly magnified, *e.g.* in emission electron microscopes used for studying thermo- and photo-cathodes, (*b*) of approximately the same dimensions as the object, *e.g.* in devices used in television, or (*c*) reduced to a point, *e.g.* in the electron gun. A brief survey of each class is given. This is followed by a detailed mathematical analysis of the formation and focusing of electron beams by electrostatic methods. Equations are derived determining the trajectories of the electrons and approximate solutions indicated. Chromatic aberration, transverse as well as longitudinal, is calculated and the plane of the optimum image found. The depth of focus, determining the accuracy of focusing, is examined. Further possible defects of electron-optical systems, such as spherical aberration, curvature of the image, and astigmatism, are also discussed. A technically ideal system would use purely electrostatic focusing, with two electrodes only. An analysis of its operation is given and possible applications are discussed.

537.533.7 : 621.383 **569**

The Electron-Optical Properties of the Magnetic Tube (Electron Multiplier) of Kubetski.—G. R. Rik. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 6, pp. 366–369. In Russian.) A detailed investigation of the tube was carried out and in this paper a brief summary of the results obtained is given. The equipotential lines of the electric field and the electron trajectories in the region of the cathode are plotted. The absence of an accelerating field near the cathode and the lack of co-ordination between the fields result in a useless dispersion of a large number of photo-electrons. The curves of focusing in the longitudinal direction are shown. The variation in the size of the emitting rings (they become wider beginning from No. 12 ring) is not adjusted to the longitudinal gradient of the magnetic field with the result that further dispersion of electrons occurs. The electron trajectories near the anode are shown in Fig. 3. The diffusion of the magnetic field in this region obstructs the collection of electrons at the anode. The general conclusion reached is that electron-optical properties of the tube are rather poor, but that they could be improved by modifying the operating conditions and altering certain constructional details. *See* also 577 below (Kubetski).

537.533.8 **570**

On the Secondary Electron Emission from Solid Bodies.—S. Y. Luk'yanoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 6, pp. 330–339. In Russian.) A general theory of the phenomenon based on modern conceptions and experimental data is presented. The penetration of a primary electron into a solid body is discussed and processes determining the appearance and intensity of secondary emission are examined in detail. It is shown that the shape of the (σ, E_p) curve is determined mainly by the ionizing effect of the primary electron (proportional to the total loss of energy per unit length) in the layer from which secondary electrons are emitted. The possibility of an experimental verification of this statement is indicated and results obtained by other investigators are quoted. A table of the latest reliable data on secondary emission for various metals is given, whence it appears that σ_{max} is low for all metals and that there is no direct relationship between it and the work function. It is suggested that the variation of σ_{max} for various metals is determined by the effect of bound electrons in the metal, and by the number of atoms per unit volume. Finally, the secondary emission from semiconductors and dielectrics is examined. Although not every semiconductor or dielectric has a σ_{max} exceeding those for pure metals, materials with very high values of σ_{max} must necessarily be semiconductors or dielectrics. The reasons for this are suggested and experimental data for some of the materials are quoted. Reference is made to the possibility of increasing the secondary emission of a material with high resistance by electron bombardment which causes the appearance of surface charges on the material. This effect is utilized in various devices, such as electron multipliers, but the author is not inclined to regard it as important.

An abstract in English was noted in 2074 of 1946.

537.533.8 **571**

The Effect of Strong Electric Fields on the Secondary Electron Emission from Thin Dielectric Films.—D. V. Zernoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 6, pp. 352–356. In Russian.) As a result of the action of an electron beam on a thin film of dielectric deposited on a metallic base, a strong field is built up in the film affecting in a number of ways the characteristics of the emitter. The effects of the field are enumerated and, in order to clarify the processes taking place in the film, a mathematical analysis is presented of the energy spectrum of the system metal-dielectric-vacuum (Fig. 1). Experiments carried out with the MgO and Al_2O_3–Cs_2O emitters are described, and the possibility of obtaining large secondary currents, especially in the form of short impulses, is indicated.

An abstract in English was noted in 2075 of 1946.

537.533.8 : 621.385 **572**

Electronic Apparatus with Effective Emitters of Secondary Electrons.—R. M. Aranovich. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 6, pp. 346–351. In Russian.) Emitters prepared by evaporating magnesium and other metals in dry oxygen are briefly discussed. The effects of various gases, of materials used for bases, of the velocity of primary electrons, of the conditions under which the evaporation of the metal is carried out, and of the manner in which the secondary voltage gradient is built up were investigated and experimental curves were plotted. Emitters with $\sigma = 80$ were produced and even with $\sigma = 100$–$10\,000$, although in the last case inertia of secondary emission was observed. The breakdown of the emitters is discussed and microphotographs showing their structure are included. An interpretation of the experimental results is offered. The operating data of a photocell and a valve with one stage of amplification are given.

An abstract in English was noted in 2390 of 1946.

537.533.8 : 621.385.1.032.216 **573**

The Emission from an Oxide Cathode under the Application of an Impulse Voltage.—A. M. Andrianoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, p. 290. In Russian.) A preliminary note on an experimental investigation in which it was found that if an impulse voltage at a frequency of 50 p.p.s. is applied to the anode of a diode with an oxide cathode, the emission from the latter at the normal temperature of 850–900°C is enormously increased and reaches the value of 30 A/sq. cm.

An abstract in English was noted in 2076 of 1946.

621.314.653 **574**

Excitation, Control, and Cooling of Ignitron Tubes.—C. C. Herskind & E. J. Remscheid. **Rectifier Capacity.**—C. C. Herskind & H. C. Steiner. (*Trans. Amer. Inst. elect. Engrs,* Oct. 1946, Vol. 65, No. 10, pp. 632–635 & 667–670.) The first paper describes the control, limitations, and operating requirements of mercury-arc tubes of the ignitron type, while the second paper deals with the load-time and volt-ampere characteristics of these tubes, the relations between these characteristics and the factors affecting them.

621.314.67 : 621.357.1 : 666.1 **575**

Electrolysis Phenomena in Soft-Glass Stems of Rectifier Tubes.—Gallup. (*See* 447.)

621.319.7 : 621.385 **576**

Plotting Electrostatic Fields.—Silva. (*See* 446.)

621.383 **577**

Some Conclusions reached from the Use of Secondary Electron Multipliers.—L. A. Kubetski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 6, pp. 357–365. In Russian.) Since the first attempts by the author in 1934 to use secondary emission for the amplification of the primary electron current, a large amount of work both experimental and theoretical has been carried out. In the present paper the results achieved are systematized and further lines of development indicated. The specific requirements for electron multipliers are enumerated and reference is made to the type evolved by the author to meet these requirements. A logical basis for further search of suitable emitters is elaborated; those of the Cu–S–Cs type developed by the author are described. Criteria determining the quality of electron multipliers are established. The maximum amplification and the threshold of sensitivity of multipliers are also discussed.

An abstract in English was noted in 2029 of 1946.

621.383 **578**

Electron Multipliers.—E. G. Kormakova. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 6, pp. 370–372. In Russian.) Since systems with a magnetic field are not convenient in use, only systems with an electrostatic field were considered. It was found that focusing was best achieved by means of grids. Accordingly a multiplier with a cylindrical grid and using caesium oxide cathode and emitters was developed. Equipotential lines and lines of force are plotted by a graphical method of successive approximation. Various characteristics of the multiplier are shown and operating data given.

An abstract in English was noted in 2028 of 1946.

621.385 **579**

On the Flow of High-Frequency Currents through Electronic Apparatus.—S. D. Gvozdover. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 5, pp. 267–274. In Russian.) It is not always possible, in designing high frequency apparatus, to regard $\theta = \omega T_0$ as a small quantity where ω is the frequency and T_0 the travelling time determined by the constant voltages. Solutions for any value of θ can be obtained in all cases without much difficulty if the approximate solutions derived by expansion in series are modified in accordance with Laplace's transformation. It is assumed that the electron stream passes between flat electrodes, and that the electron velocity is a single-valued function of the coordinates, *i.e.* that the electrons cannot overtake one another.

Equations (1–4) determining the movement of the electrons between the electrodes are given, and an approximate solution (14) is derived by expansion. Laplace's transformation is applied to this solution, and a modified formula (15) is derived which is more suitable for calculations. The results obtained are used in a discussion divided into the following sections: (*a*) the determination of the current in the external circuit, and of the power consumed; (*b*) the determination of the self-excitation regions in the case of a single-circuit klystron (' monotron '); (*c*) the determination of the dielectric constant of an electron gas; (*d*) an analysis of the rectification of h.f. currents in a diode; (*e*) the calculation of the amplitude of stationary oscillations in a monotron.

An abstract in English was noted in 2389 of 1946.

621.385 **580**

The Role of Surface Charges in Electronic Apparatus.—P. V. Timofeeff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 6, pp. 340–342. In Russian.) While the effects of space charges are widely used in electronic apparatus, little attention has been paid to the possibility of utilizing charges appearing on the surface of insulators inside the apparatus. Normally these charges are formed as a result of secondary emission from the insulators, caused by electron bombardment. An insulator can thus be charged to a high positive potential and the following three possible applications of this effect are indicated: (*a*) an insulator mounted near the cathode and acquiring a high positive charge may produce a potential gradient sufficient for cold emission of electrons from the cathode; (*b*) the high secondary emission from caesium-oxide cathodes is probably due to the presence of dielectric particles in the cathodes, which may acquire positive charges (Fig. 1); this opens a possibility for a further increase in the secondary emission; (*c*) positive charges also would assist photo-emission from caesium-oxide cathodes which may be achieved by making this effect more pronounced.

An abstract in English was noted in 2388 of 1946.

621.385 **581**

The Mechanism of the Operation of Kenotrons with Cold Cathodes.—V. V. Sorokina. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 6, pp. 343–345. In Russian.) A brief description is given of a kenotron developed in Russia and consisting essentially of a nickel cylinder (the anode) in a cylindrical glass envelope on which a layer of caesium oxide (the cathode) is deposited. A characteristic of the kenotron is plotted and discussed.

An abstract in English was noted in 2387 of 1946.

621.385 : 519.24 **582**

Analysis of Special Electronic-Tube Tests.—J. H. Campbell & C. G. Donsbach. (*Trans. Amer. Soc. mech. Engrs,* July 1946, Vol. 68, No. 5, pp.

481–486.) Illustrates the improvements in valve manufacturing technique which may be accomplished by controlled tests on valves in the course of production, followed by statistical analysis of the results.

621.385 : 621.317.723 **583**

Improvements in the Stability of the FP-54 Electrometer Tube.—J. M. Lafferty & K. H. Kingdon. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 699.) Greater stability was obtained by increasing the activation time from 8 to 40 minutes. Filament end shields also reduced rapid fluctuations. A special split tube using both oxide-coated and thoriated tungsten filaments was made which eliminated long-term drift in a bridge circuit and reduced rapid fluctuations tenfold. Summary of Amer. Phys. Soc. paper.

621.385 : 621.395.613 **584**

" Vibrotron " Tube.—R.C.A. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, p. 282.) A small electron tube for translation of mechanical motion into variable electron flow, which can be used in microphones. When used in a gramophone pickup it is claimed that the tube will perform up to the highest requirements of fidelity and sensitivity. The tube is a metal triode about 1 inch in length, and $\frac{1}{4}$ inch in diameter weighing $\frac{1}{15}$ oz.

621.385.029.63/.64 **585**

The Travelling Wave Valve.—R. Kompfner. (*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 369–372.) Amplification in transit-time valves may be greatly increased if a field travelling at the speed of the electrons is used instead of a stationary electric field. By this means electron acceleration is obtained in both half cycles of the wave. Such a field can be produced if the signal travels along a helix of suitable dimensions. The presence of the electron beam also causes amplification in the wave itself, hence the helix—electron-beam system is an amplifier. Experimental data on this type of tube are briefly mentioned, and future applications, including television and u.h.f. transmissions, suggested.

621.385.029.63/.64] **586**

Traveling Wave Tubes.—M. A. Barton. (*Radio, N.Y.*, Aug. 1946, Vol. 30, No. 8, pp. 11–13 . . 32.) A simple description of the new centimetre-wave tube, in which an electron beam is transmitted along the axis of a long narrow helix, which acts as a waveguide with a low velocity of propagation. The tube gives high gain over a broad band in the region of 4 000 Mc/s. For another account see *Elect. World, N.Y.*, 21st Sept. 1946, Vol. 126, No. 12, pp. 20–21.

621.385.1 **587**

The Theory of a Reflex Klystron.—S. Gvozdover. (*Zh. eksp. teor. Fiz.*, 1945, Vol. 15, No. 9, pp. 521–531. In Russian.) The resonant frequencies of a reflex klystron are calculated as a function of its dimensions and the applied voltages. Graphs and formulae for computation are given.

621.385.1 **588**

The Maximum Efficiency of Reflex Oscillators.—E. G. Linder & R. L. Sproull. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 700.) A formula is given for maximum efficiency with optimum electron bunching and loading. Possible methods of increasing efficiency are investigated. Summary of Amer. Phys. Soc. paper.

621.385.12 : 621.396.822 **589**

Cold-Cathode Gas Tubes as Noise Generators.—S. Ruthberg. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 112.) A glow tube, a mercury arc with mercury-pool electrodes, and a corona discharge monode were examined. The glow tube gave spectra from 0.05 to 5 Mc/s, and oscillations and noise were affected by a transverse magnetic field. See also 3267 of 1946 (Gallagher & Cobine). The mercury arc was not sufficiently stable for quantitative measurements, and the corona monode gave noise of a steep pulse character.

Summary of an Amer. Phys. Soc. paper.

621.385.16 **590**

How the Magnetron Works.—" Radionyme ". (*Toute la Radio*, Jan. 1946, Vol. 13, No. 102, pp. 26–28.) The performance of three types is noted : (*a*) British, with 8 resonant cavities 100-kW peak power, 1-μs pulses, 600 pulses per sec, wavelength 9 cm, 15-kV anode voltage, 20-A anode current, magnetic field 1 700 oersteds, and efficiency 30% ; (*b*) Russian, with 116 W on c.w. at wavelength 9 cm, and efficiency 22% ; (*c*) German, with peak power 8 kW and wavelength 1.75 cm.

621.385.8 : 538.6 **591**

Magnetically-Controlled Gas Discharge Tubes.—R. E. B. Makinson, J. M. Somerville, K. R. Makinson & P. Thonemann. (*J. appl. Phys.*, July 1946, Vol. 17, No. 7, pp. 567–572.) In these tubes, a glow discharge is initiated by means of a magnetic field pulse. Ions from this discharge produce an arc spot on the pool of mercury through which the main current passes. A current pulse of 200 A of duration 1 to 10 sec can be used.

621.385.8.032.21 : 537.525.83 **592**

The Normal Cathode Fall for Molybdenum and Zirconium in the Rare Gases.—T. Jurriaanse, F. M. Penning & J. H. A. Moubis. (***Philips Res. Rep.***, April 1946, Vol. 1, No. 3, pp . 225–238.) In gas-discharge tubes with molybdenum or zirconium cathodes greater stability of the voltage maintaining the discharge has been obtained by sputtering the cathode material over the whole of the walls of the tube. The action of this metallic layer is thought to be partly due to absorption of gases released from the walls during the discharge and partly to its screening action which prevents the liberation of such gases.

621.385.82.029.3 : 621.395.61 **593**

[The development of] **a High Power Thermionic Cell using Positive Ion Emission and operating in a Gaseous Medium.**—S. Klein. (*Onde élect.*, Oct. 1946, Vol. 26, No. 235, pp. 367–373.) The cell is small, cylindrical in shape and comprises an axial heater surrounded by a ceramic sheath on the outer surface of which finely divided platinum is deposited. This anode is surrounded by a silver cylindrical cathode ; the inter-electrode spacing is about 1 mm. Positive ion currents of the order of several tens of microamperes are produced at atmospheric pressure for a polarizing voltage of a few hundred volts. Since the current depends on pressure, the cell may be used as a microphone at audio and sub-audio frequencies. Conversely the cell may be used as a loudspeaker since energy from the pulsating ion stream is lost to the air molecules. A ' triode ' version of the cell is also described for the loudspeaker application. The pressure/current characteristic for the diode is given.

621.385(075) **594**

Elektronenröhren. [Book Review]—A. Daeschler. Archimedes Verlag, Zürich, 1945, 104 pp., Swiss Fr. 6.80. (*Tech. wet. Tijdschr.*, April/May 1946, Vol. 15, Nos. 4/5, p. 50. In Flemish.) First of a series of textbooks on radio, intended for the radio serviceman.

MISCELLANEOUS

001.8 **595**

Scientific Information Services.—(*Nature, Lond.*, 14th Sept. 1946, Vol. 158, No. 4011, pp. 353–356.) Editorial on the report of the Royal Society on needs of post-war research, with special reference to publication and scientific intelligence. It is estimated in the report that in physics and chemistry alone, at least two thousand papers will now be released for publication but cannot be published without substantial assistance from Treasury funds.

001.89 : 621.396 **596**

The 7th General Assembly of the International Radio-Scientific Union.—A. Haubert. (*Onde élect.*, Oct. 1946, Vol. 26, No. 235, pp. 391–393.) Held in Paris, 27th Sept. to 5th Oct. 1946. Committees were set up on measurements, propagation (ionospheric and tropospheric), atmospherics and radiophysics.

535.65 : 001.4 **597**

International Names of Colorimetry.—P. Moon & D. E. Spencer. (*J. opt. Soc. Amer.*, July 1946, Vol. 36, No. 7, pp. 427–428.) A study of internationality in the endings of scientific words shows that the following endings are ordinarily used with the same meanings in most of the languages of Europe and America : *-or* = a device ; *-tion* = a process ; *-ance* = a passive property of a device ; *-ity* = a passive property of a substance. Thus these endings may be regarded as international, and their use in the coining of new scientific terms should be encouraged.

6(43) **598**

A Classified List of Industrialists' Reports on Germany [up to 27th July 1946].—CIOS, BIOS, FIAT, & JIOA. Obtainable from H.M. Stationery Office.

Section F covers electrical engineering industry, including radio ; Section D includes plastics ; Section G, glass and ceramics ; and Section K, metals.

620.193.8(213) **599**

The Deterioration of Materiel in the Tropics.—Hutchinson. (*See* 438.)

621.3 : 371.3 **600**

Post-Graduate Courses in Electrical Engineering, including Radio.—(*J. Instn elect. Engrs*, Part III, Sept. 1946, Vol. 93, No. 25, pp. 363–364.) Summary of I.E.E. Radio Section discussion led by W. Jackson and J. Greig on the " means by which qualified electrical engineers might acquire, and sustain, an intimate knowledge of the particular branches of the subject in which their individual contributions [are] to be made." See also 2435 of 1946.

621.38/.39 + 331(07) : 621.3 **601**

Post-War Development Report.—(*J. Brit. Instn Radio Engrs*, Oct./Dec. 1944, Vol. 4, No. 3, pp. 135–161.) In part 1 the whole field of electronics is briefly surveyed, and the outstanding problems in each branch are mentioned. In part 2 the provision of staff for the development programme, and their education and training, are discussed.

621.395(091) **602**

A Critical Review of the History of the Controversy concerning the Invention of the Telephone examined in the Light of Contemporary Literature.—C. Frachebourg. (*Tech. Mitt. schweiz. Telegr.-Teleph Verw.*, 1st Feb. 1946, Vol. 24, No. 1, pp. 36–42. In French.)

621.396.9 **603**

I.E.E. Radiolocation Convention, March 1946.—(*J. Instn elect. Engrs*, Part I, Oct. 1946, Vol. 93, No. 70.) Summaries of the survey papers read at the Convention are given. A bibliography of the remaining papers connected with the Convention is also included ; these papers together with fuller versions of the survey papers are being published in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, Nos. 1–9, and will be abstracted in due course.

621.882.082.2 **604**

The Unification of Screw-Thread Practice.—(*Engineering, Lond.*, 13th Sept. 1946, Vol. 162, No. 4209, pp. 253–254.) Proposal for a modification of the standard Whitworth thread, to one of 60° angle with flat or rounded crests, and rounded roots.

621.38 (02) **605**

An Introduction to Electronics. [Book Review]—R. G. Hudson. Macmillan, New York, 93 pp., $3.00. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1946, Vol. 7, No. 10, p. 31.)

621.396 **606**

The Wireless Trader Year Book. [Book Notice]—Iliffe & Sons, London, 1946, 160 pp., 10s. 6d. (*Electrician*, 19th July 1946, Vol. 137, No. 3555, p. 185.)

621.396 **607**

Radio. [Book Notice]—National Bureau of Standards, 87 pp. (*U.S. Govt. Publ.*, July 1946, No. 618, p. 730.) Revised classification of radio subjects dated 11th Jan. 1946.

621.396 **608**

Précis de Radioélectricité. [Book Review]—E. Divoire. Éditions Desoer, Liège, 1945, 222 pp., 171 figs. (*Tech. wet. Tijdschr.*, Oct./Dec. 1945, Nos. 10/12, p. 114. In Flemish.) " . . A survey of the theory and applications, addressed to engineers, scientists and university students, who wish to extend their knowledge to this new field . . ."

621.396(075) **609**

Experimental Radio. [Book Review]—R. R. Ramsey. Ramsey Publishing Co., Bloomington, Indiana, 4th edn 1937, 196 pp., $ 2.75. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1946, Vol. 7, No. 9, p. 29.) " Very little theory appears in the text, it being the aim of the author to make the student think for himself." A very practical and useful book, " which does not suffer as a result of the age of its subject matter."

621.396.029.6 **610**

Ultra-High-Frequency Radio Engineering. [Book Review]—W. L. Emery. Macmillan, New York, 1944, 281 pp., $ 3.25. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1946, Vol. 7, No. 9, pp. 37–38.) " . . . The treatment is generally fairly simple and confined to basic principles."

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.222.1 + 538.566.2 **611**

Propagation of Radiation in a Medium with Random Inhomogeneities.—Bergmann. (*See* 847.)

534.32 : 621.396.722 **612**

Tonal-Range and Sound-Intensity Preferences of Broadcast Listeners.—H. A. Chinn & P. Eisenberg. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1946, Vol. 34, No. 10, pp. 757–761.) Discussion of 3567 of 1945.

534.43 : 621.395.613.32 **613**

Phonograph Pickup using Strain Gage.—K. J. Germeshausen & R. S. John. (*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 78–79 . . 120.) This uses the change in resistance of a carbon layer, which is elongated or compressed by the moving stylus. It is a simple, rugged device giving good performance.

534.75 **614**

The Threshold of Audition for Short Periods of Stimulation.—J. W. Hughes. (*Proc. roy. Soc. B*, 3rd Dec. 1946, Vol. 133, No. 873, pp. 486–490.) The threshold of audition rises as the period of stimulation is decreased. The relationship between these two quantities is similar to that found for other sensory mechanisms.

534.851.001.4 **615**

Disc Recording.—H. A. Chinn. (*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 64, 66.) Stresses the need for standard groove shape and for far wider co-operation between the makers of records and of reproducers.

534.851.6 **616**

Recording Styli.—I. L. Capps. (*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 65, 67 . . 110.) Discusses the effect of stylus contour, cutting edge and burnishing facet in lacquer-disk recording.

621.395.623.73 : 534.415 **617**

Stroboscopic Study of Loud-Speaker Membranes.—J. Fasal. (*Toute la Radio*, July/Aug. 1946, Vol. 13, No. 107, pp. 178–181.) An account of basic principles of the stroboscope and their special application to the study of the vibrations of loudspeaker membranes.

621.395.625 : 621.395.645 **618**

40-Watt Beam-Power Amplifier for Disc Recording.—J. K. Hilliard. (*Communications*, Nov. 1946, Vol. 26, No. 11, pp. 22–24.) The response of the input is pre-equalized so that the highest frequencies recorded are emphasized greatly, and the amplifier is designed to maintain rated output up to these frequencies.

621.395.625.3 **619**

Signal and Noise Levels in Magnetic Tape Recording.—D. E. Wooldridge. (*Trans. Amer. Inst. elect. Engrs*, June Supplement 1946, Vol. 65, p. 495.) Discussion of 2804 of 1946.

621.395.625.3 **620**

A New Wire Recorder Head Design.—T. H. Long. (*Trans. Amer. Inst. elect. Engrs*, June Supplement 1946, Vol. 65, pp. 495–497.) Discussion of 2127 of 1946.

621.395.667 **621**

Wide Range Tone Control.—J. M. Hill. (*Wireless World*, Dec. 1946, Vol. 52, No. 12, pp. 422–423.) Description and diagram of a circuit suitable for tone correction at low volume levels.

621.396.615.029.3 **622**

Low Cost Audio Oscillator.—R. W. Ehrlich. (*Radio News*, Nov. 1946, Vol. 36, No. 5, pp. 50–51 . . 110.) Resistance-tuned, 100 to 25 000 c/s.

621.396.645.36.029.3 **623**

Class B Audio-Frequency Amplifiers.—F. Butler. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 14–19.) The distortion introduced by the variable grid input impedance into a conventionally connected Class B amplifier is considered. By earthing the grid and injecting at the cathode, a very low but comparatively constant input impedance is achieved. Although considerable excitation power is required, " a large proportion of this appears as useful output." The design of a practical push-pull amplifier using cathode injection is outlined.

AERIALS AND TRANSMISSION LINES

621.314.214 **624**

A Tuned-Line Matching Transformer.—T. A. Gadwa. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 36–38.) Matching of an open-wire line to a close-spaced beam aerial, or other low impedance, is effected by means of an adjustable capacitor in combination with short parallel lines for the inductance elements. Adjustment procedure is described.

621.315.1.015.3 + 621.316.98 **625**

Study of Transient Voltages on Lines struck by Lightning. Protection by Lightning Arresters.—G. Bodier. (*Rev. gén. Élect.*, May 1946, Vol. 55, No. 5, pp. 199–215.)

621.315.2 : 621.317.372 **626**

End Leakage in Cable Power-Factor Measurement.—Rosen. (*See* 795.)

621.315.2.015.532 **627**

Detecting Corona in Cables.—W. J. King. (*Bell Lab. Rec.*, Nov. 1946, Vol. 24, No. 11, pp. 413–415.) As it forms, usually in air pockets between the conductor and its shield, corona produces an electrical disturbance which can be detected and amplified by the test equipment. Tests at reduced pressure are included for cables to be used at high altitudes in aircraft.

621.315.21 **628**

Propagation along a Cable having Resistance and Capacitance only, these Parameters being Functions of Position and satisfying Certain Relations.—M. Parodi. (*C.R. Acad. Sci., Paris*, 3rd Sept. 1945, Vol. 221, No. 10, pp. 257–259.) By means of the Laplace transformation an expression is derived for the voltage distribution along the line from which the current can be calculated. A similar method is applicable to a line having only inductance and capacitance.

621.315[.211.2 + .22 **629**

Mineral-Insulated Metal-Sheathed Conductors.—F. W. Tomlinson & H. M. Wright. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 561–562.) Summary of 12 of January.

621.319.7 : 621.392 **630**

Some Applications of Field Plotting.—E. O. Willoughby. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 543–545.) Summary of 2814 of 1946.

621.392 + 621.316.35.011.3 **631**

Formulas for the Inductance of Coaxial Busses comprised of Square Tubular Conductors.—H. P. Messinger & T. J. Higgins. (*Trans. Amer. Inst. elect. Engrs*, June Supplement 1946, Vol. 65, p. 501.) Discussion of 2815 of 1946.

621.392 : 621.317.784 **632**

A Wide-Band Wattmeter for Wave Guide.—Early. (*See* 813.)

621.392 : 621.397.62 **633**

The Choice of Transmission Lines for connecting Television Receiving Aerials to Receivers.—F. R. W. Strafford. (*Tech. Bull. Radio Component Mfrs' Fed.*, Nov. 1946, Vol. 1, No. 2, pp. 3–5.) Various possible types of transmission line are considered ; the twin unscreened feeder with a pair of ' Fahnstock ' terminal plugs is likely to be the most satisfactory for simple domestic television aerial installations.

621.392.012.8 **634**

The Equivalent Circuit for a Plane Discontinuity in a Cylindrical Wave Guide.—J. W. Miles. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1946, Vol. 34, No. 10, pp. 728–742.) Equivalent circuits representing a plane discontinuity consisting of a junction between two waveguides of arbitrary cross-section are given and the values of the equivalent impedances enumerated.

It is shown that in general the equivalent circuit takes the form of a T-network, but that in many cases it reduces to an ideal transformer plus a shunt element. For discontinuities such as slots in guide walls it is shown that an equivalent π-network is a better representation.

The theory is applied to a transverse wire, capacitive and inductive windows, and capacitive and inductive cross-sections in a rectangular guide, and approximate expressions for the impedances are deduced.

621.392.21 **635**

Propagation along any Line whose Parameters, Functions of Space, satisfy at All Points a Condition Analogous to that of Non-Distortion.—M. Parodi. (*Rev. gén. Élect.*, Oct. 1946, Vol. 55, No. 10, pp. 414–415.) Extends the results of 550 of 1946 (Colombo & Parodi).

621.396.67 **636**

A Folded Unipole Antenna for Emergency Communications.—J. S. Brown. (*Communications*, Nov. 1946, Vol. 26, No. 11, pp. 18–20.) A quarter-wave system using vertical polarization and having broad-band impedance characteristics with omnidirectional horizontal radiation pattern. Graphs are given for standing-wave ratio and aerial impedance over the frequency range 30–44 Mc/s.

621.396.67 : 621.396.712 **637**

Postwar Broadcast Antenna Installation.—D. W. Jefferies. (*Communications*, Nov. 1946, Vol. 26, No. 11, pp. 11–13, 34.) Description of the construction and erection of a $\lambda/4$ self-supporting steel radiator for 1 450 kc/s using a 48 ft × 48 ft square mesh mat with 90 radial wires each $\lambda/4$ long. Arrangements are described for obstruction lighting ; and for a.f. monitoring using germanium crystal rectifiers.

621.396.67.029.56/.58 **638**

A Unique Five-Band Antenna System.—J. A. McCullough. (*QST*, Dec. 1946, Vol. 30, No. 12, pp. 29–31 . . 136.) Describes a novel means of using combinations of the supporting tower and four parallel dipoles (rotary) to cover all bands from 3.5 to 28 Mc/s.

621.396.67.029.58 **639**

10-Meter Vertical Coaxial Antenna.—C. V. Hays. (*Radio News*, Nov. 1946, Vol. 36, No. 5, pp. 88 . . 92.) Constructional details.

621.396.67.029.58 **640**

A Simple Rotatable Antenna for Two Bands.—R. J. Long. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 22–24.) A two-element array for 14 and 28 Mc/s.

621.396.67.029.64 : 621.396.931 **641**

V.H.F. Antenna for Trains.—E. G. Hills. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 134–136.) A top-loaded, folded, vertically-polarized, monopole aerial (for 160 Mc/s) concentrates radiation close to the ground in an omni-directional pattern. The aerial is only five inches high, mechanically rugged, and has an input impedance of 50 Ω. Design techniques are described.

621.396.671 : 621.396.822 **642**

Study of the Thermal Equilibrium of Wireless Aerials.—G. Lehmann. (*Ann. Télécommun.*, May/June 1946, Vol. 1, Nos. 5/6, pp. 91–98.) The black-body radiation law is used to determine the intensity of the r.f. noise field in a uniform temperature enclosure. The noise e.m.f. induced in a dipole corresponds to the value given by applying Nyquist's formula to the radiation resistance. The identity of the polar diagrams of any aerial for reception and for transmission is established. In practice extraterrestrial noise (from the galaxy and the sun) leads to relatively high aerial noise temperatures at metre wavelengths. The relations between the aperture, the beam width and the gain of a directive aerial are deduced. The paper was first published in September 1942 in *Cahiers de Physique*. See also 2122 of 1941 and 2699 of 1946 (Burgess).

621.396.677 **643**

A High-Gain Two-Meter Rotary Beam.—J. A. Kmosko. (*QST*, Nov. 1946, Vol. 30, No. 11, pp. 45–47.) A six-element broadside parasitic array with coaxial feed, which has a forward gain of 12 db, a front-to-back ratio of 36 db and a beam width of ± 10° for half power.

621.396.677 **644**

Directional Patterns of Rhombic Antennae.—W. N. Christiansen. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 33–51.) " Spatial directional patterns of typical rhombic antennae are given. It is shown that a design which involves the application of the simple ' alignment ' relation at the geometric mean of the frequency range is much superior at the higher frequencies to one in which a wider aperture has been used to obtain higher output at this mean frequency.

" A comparison with the pattern of a large tuned array shows the inferiority of a single rhombic antenna. Many of the prominent minor lobes seen in the directional pattern of the latter may be suppressed by the use of several rhombics in the form of an array. Various simple designs are discussed and it is shown possible, particularly when the rhombics are arranged in an interlaced ' end-fire ' array, to produce over the whole working range of the rhombic, a directional pattern which compares well with that of a large tuned array at its designed frequency."

621.396.677.2 **645**

Five are Better than Three. Some Experiences with a Five-Element Rotary.—W. W. Basden. (*QST*, Dec. 1946, Vol. 30, No. 12, pp. 32..138.) The five-element 28-Mc/s beam at W5CXS is different from the usual three-element beam in that director elements have been added 0.1 λ above and below the normal director. Delta-match feed was used and the line is tapped on the radiator 13 inches each side of the centre.

621.396.679.4 **646**

Dipole with Unbalanced Feeder.—D. A. Bell. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 3–5.) A short account of the effect of pick-up on the concentric downlead from a directly connected dipole receiving aerial. The equivalent circuit of such an aerial arrangement is discussed and the function of a quarter-wave balancing sleeve is considered. An example is given showing the distortion of the polar diagram of an array produced by feeder-lead pick-up.

621.396.931/.933].22.029.62 **647**

Radio Direction Finding at 1.67 Meter Wavelengths.—Yuan. (*See* 732.)

CIRCUITS AND CIRCUIT ELEMENTS

621.314.26 **648**

Mechanism of Frequency Changing.—L. Chrétien. (*Toute la Radio*, March/April & May 1946, Vol. 13, Nos. 104 & 105, pp. 76–78 & 104–106.) Criticizes existing theories of the behaviour of frequency changing circuits and puts forward a new theory based on the stroboscopic effect.

621.315.59 + 621.316.89 **649**

Properties and Uses of Thermistors — Thermally Sensitive Resistors.—Becker, Green & Pearson. (*See* 765.)

621.317.432 **650**

Energy dissipated by Eddy Currents in a Thin Ferromagnetic Disk Normal to the Field.—G. Ribaud. (*C. R. Acad. Sci., Paris*, 25th March 1946, Vol. 222, No. 13, pp. 726–727.) Formulae have previously been given (3811 of 1944) for the energy dissipated by eddy currents in a thin non-magnetic disk. The difference in the case of a magnetic material results essentially from magnetic charges on the faces of the disk which produce a uniform demagnetizing field, which is added to that due to the eddy currents. The ratio of the energy dissipated in a magnetic disk to that in a non-magnetic disk of the same resistivity, has a maximum value of $r/4\epsilon$ when $\mu = r^2/\epsilon^2$, μ being the permeability, ϵ the skin thickness and r the distance from the axis. The energy dissipation formulae given are only valid when the thickness of the disk is more than 2 or 3 times the skin thickness.

621.318.423.012.3 **651**

Mutual Inductance of Concentric Coils.—T. C. Blow. (*Electronics*, Nov. 1946, Vol. 19, No. 11, p. 138.) A nomogram for calculating mutual inductance between two concentric single-layer air-core solenoids with greater length than diameter.

621.318.7 **652**

Tchebycheff Polynomials and the Theory of Electric Filters.—A. Colombani. (*C. R. Acad. Sci., Paris*, 27th May 1946, Vol. 222, No. 22, pp. 1278–1280.) The successive intensities in a filter of n cells are shown to depend on polynomials which satisfy Tchebycheff's equation. The particular solution applicable to the filter enables a simple formula for the intensities to be derived.

621.319.4 **653**

Modern Capacitors.—R. Besson. (*Toute la Radio*, June 1946, Vol. 13, No. 106, pp. 139–142.) Discusses the temperature, loss and other characterstics of electrolytic capacitors, capacitors with paper dielectric and those using silvered mica or ceramic material.

621.319.4 : 621.315.614.6 **654**

Paper Capacitors containing Chlorinated Impregnants — Mechanism of Stabilization.—L. Egerton & D. A. McLean. (*Bell Syst. tech. J.*, Oct. 1946, Vol. 25, No. 4, pp. 652–653.) Barrier films formed on the electrodes reduce the catalytic decomposition of the chlorinated impregnant of the electrode metal, prevent attack of the electrodes by liberated hydrogen chloride and hinder electrolytic action. Abstracted from *Industr. Engng Chem.*, May 1946. For part 3 of this article see 655 below.

621.319.4 : 615.315.614.6 **655**

Paper Capacitors containing Chlorinated Impregnants : Part 3 — Effects of Sulfur.—D. A. McLean, L. Egerton & C. C. Houtz. (*Industr. Engng Chem.*, Nov. 1946, Vol. 38, No. 11, pp. 1110–1116.) Sulphur is an effective stabilizer with both tin and aluminium electrodes and improves the power factor especially with tin foil electrodes. Previous findings confirmed by the tests are : the importance of all parts of the capacitor, the superiorities of kraft paper over linen, and the widely different behaviours of capacitors with different electrode metals. For an earlier part in this series see 654 above.

621.392 **656**

Analysis of Linear Sweep Generator.—E. L. Langbergh. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 194..198.) A theoretical analysis of a timebase circuit consisting of a capacitor which charges in series with a valve having negative current feedback. The degree of nonlinearity depends on valve characteristics and on the charging rate of the capacitor. Details of a practical laboratory circuit are given using a high-μ pentode as the charging valve and a gasfilled triode as the discharging device.

621.392 **657**

The Transfer Impedance of Recurrent Π and T Networks.—J. B. Rudd. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 79–87.) The transfer impedances are derived for chains of up to six sections of symmetrical Π and T networks terminated in equal resistances. Where the product of the impedance values of the arms of the Π and T sections is equal to the square of the terminating resistance, the circuits have identical transfer impedances.

621.392 : 621.385.832 **658**

Design of Cathode-Ray Tube Circuits.—W. Knoop. (*QST*, Dec. 1946, Vol. 30, No. 12, pp. 45–50..160.) The operation of a c.r.t., and methods of using it in designing power supply and control circuits, are explained.

621.392 : 621.396.615 **659**

The Design of Parallel-T Networks for RC Oscillators.—L. E. V. Lynch & D. S. Robertson. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 7–25.) ". . . the theory of unbalanced parallel-T networks is developed and the application to resistance-capacitance oscillators is discussed. Curves are given to facilitate the design of such oscillators, together with a typical oscillator circuit showing a new method of applying automatic gain control to the associated amplifier."

621.392.5 **660**

Theory of the 'Enclosed' [encadré] **Linear Quadripole.**—P. Grassot. (*Rev. gén. Élect.*, Nov. 1946, Vol. 55, No. 11, pp. 443–448.) The term 'quadripôle encadré' is used for a quadripole interposed between a source and a dipole receiver. General considerations are applied to a discussion of the case of a non-dissipative enclosed quadripole consisting of pure resistances, leading to the formulation of three theorems. Examples are given of their application. The results may also be applied to telephone transformers, tuned transformers, filters, lines, etc.

621.392.52 **661**

Rigorous Formula for the Attenuation Constant of a Filter.—P. Marié. (*C. R. Acad. Sci., Paris*, 8th April 1946, Vol. 222, No. 15, pp. 869–870.) A rigorous formula is derived for the attenuation ratio produced by a filter made up of $(n-1)$ quadripoles, of iterative impedances Z_0 and Z_n, when the filter is terminated by an impedance z_n and the source presents an internal impedance z_0.

621.392.52.015.33 **662**

Transient Response of Filters.—E. T. Emms. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 27–28.) Comment on 48 of January (Eaglesfield) and 1188 of 1946 (Tucker). It is shown "that if the wave $\cos\omega_0 t . \mathbf{1}$ is put into a band-pass network then the envelope of the output wave is exactly the same as the output wave obtained when unit step is placed into the low-pass analogue."

621.394/.397].645 **663**

Cathode Follower of Very Low Output Resistance.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 206 . . 210.) Abstract of a report by C. M. Hammack, of the Radiation Laboratory of M.I.T. A two-stage cathode follower is described having the normal cathode load resistance of the first stage replaced by a second valve. The output conductance is shown to be increased by a factor μ over the conventional circuit. The response to pulses is also greatly improved.

621.395.667 **664**

Design of Constant Impedance Equalizers.—A. W. J. Edwards. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 8–14.) "Some useful properties of inverse networks (as used in line equalization) are deduced and applied to the development of simple practical design procedures involving no calculations when suitable test equipment is available."

621.396.61.015.33 **665**

Calculation of the Minimum Pass Band of a Pulse Transmission System.—J. Laplume. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 327–332.) The rate of rise of the output potential from a transmission system when a Heaviside pulse is applied to the input may be increased by improving the h.f. response of the system. The output then has an oscillatory form.

Transmission systems which distort the applied pulses in the same way have sensibly identical response curves and it is therefore possible to define mathematically an output signal type and deduce the response curve which produces this signal from the input pulse. The pass-band of such a system is worked out in terms of two characteristics of the output pulse, namely, amplitude of the first oscillation and a quantity measured from the steeply rising part of the potential-time curve of the pulse.

621.396.611 **666**

Increment Features on Variable Oscillators.—A. R. A. Rendall. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, p. 350.) The frequency of an oscillator can be expressed in the form $f_0 = 1/2\pi RC$. By connecting in series with the main variable capacitor C a fixed capacitor C_1, the new frequency will be $f_1 = (C + C_1)/2\pi RCC_1$, so that the increment of frequency is $1/2\pi RC_1$, which is independent of C.

621.396.611 **667**

Stability and Frequency Pulling of Loaded Unstabilized Oscillators.—J. R. Ford & N. I. Korman. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1946, Vol. 34, No. 10, pp. 794–799.) "Conditions are established under which the frequency of a loaded unstabilized oscillator will not jump discontinuously as the load susceptance is changed. Frequency-pulling equations and stability criteria are established for an oscillator coupled to a resistive load through a pair of coupled resonant circuits."

621.396.611 : 621.396.615.18 **668**

The Inductance-Capacitance Oscillator as a Frequency Divider.—Norrman. (*See* 817.)

621.396.611.1 + 531.12 **669**

Calculation of the Natural Frequencies of Nonlinear Systems.—H. Jounin. (*C. R. Acad. Sci., Paris*, 20th May 1946, Vol. 222, No. 21, pp. 1203–1205.) The method of approximation for quasilinear systems proposed by Kryloff and Bogolouboff in their "Introduction to Nonlinear Mechanics", is applied to the case of a certain class of isochronous oscillators to obtain a simple formula.

621.396.611.1 **670**

Constant Current Circuits.—O. T. Fundingsland & G. J. Wheeler. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 130–133.) "Exponential circuits can be made to carry more nearly constant current for longer times if corrective networks are used. Design equations and actions of these circuits are derived, and their advantages in magnetron pulse circuits are illustrated by a numerical example."

621.396.611.3.015.33 **671**

Transient Response of V.F. [video frequency] **Couplings.**—W. E. Thomson. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 20–27.) "Formulae and curves are given for the response to the Heaviside unit function of a single [frequency-compensated] resistance-capacitance coupled stage . . . The analysis of the low-frequency response deals mainly with the compensation of grid coupling by anode decoupling . . ." For h.f. compensation the case in which a reactance is inserted in series with the load resistor is analysed, critical damping being assumed.

621.396.615.11 **672**

A Resistance-Capacitance Beat-Frequency Oscillator.—D. S. Robertson & L. C. Nye. (*A. W. A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 27–31.) Accuracies of ±2 c/s from 20–200 c/s and of 1% from 200–5 000 c/s, and high stability with respect to temperature and supply voltage variations are claimed. The unit is light and can be used in aircraft; it may be operated from a 120 or 240 V, 50–800 c/s, supply.

621.396.615.142 **673**

Reflex Oscillators.—J. R. Pierce. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, pp. 345–346.) Summary of paper noted in 3530 of 1945.

621.396.615.17 : 621.396.96 **674**

Coil Pulsers for Radar.—E. Peterson. (*Bell Syst. tech. J.*, Oct. 1946, Vol. 25, No. 4, pp. 603–615.) A method of generating regularly spaced, sharply peaked pulses of high power for modulating h.f. generators by making use of the variation of reactance with current of molybdenum permalloy-cored coil. Pulse widths were obtained from 0.2 to over 1 μs, peak powers from 100 to 1 000 kW and pulsing rates from 400 to 3 600 pulses/sec.

The principles of operation of a low power coil pulser working from an a.c. input and of a high-power apparatus for d.c. operation are described.

621.396.619.23 **675**

A 15-Watt Modulator for Low-Power Work.—B. H. Geyer, Jr. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 28, 104.) Uses a cathode-follower type of driver with resistance coupling.

621.396.62.029.64 **676**

Components of U.H.F. Field [strength] **Meters.**—Karplus. (*See* 819.)

621.396.645 **677**

Oscillation Conditions in Single Tuned Amplifiers.—W. R. Faust & H. M. Beck. (*J. appl. Phys.*, Sept. 1946, Vol. 17, No. 9, pp. 749–756.) The gain of a tuned amplifier of n similar stages is calculated. A certain minimum grid-to-plate capacitance is required to cause oscillation. There also exists a region of stable gain, zero to $2^{1/n}$ (approx.) within which no oscillation will occur however large the grid-to-plate capacitance.

621.396.645 **678**

Design of Broad Band I.F. Amplifier : Part 2.—R. F. Baum. (*J. appl. Phys.*, Sept. 1946, Vol. 17, No. 9, pp. 721–730.) The mathematical analysis for broad band amplifiers of the stagger-tuned type is given. The resonant frequencies of the tuned circuits are assumed to be arranged in pairs so that the geometric mean of each pair is the mid-band frequency, and the two circuits of each pair have equal Q. An exact solution is possible for either a monotonic or an oscillatory response but the latter is shown to be preferable because for a given response characteristic (*i.e.* a given gain tolerance within the pass band and given minimum attenuation outside it) the oscillatory type requires fewer stages. For part 1 see 3223 of 1946.

621.396.645.35 **679**

A D.C. Amplifier using a Modulated Carrier System.—R. A. Lampitt. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, pp. 347–350.) Many of the difficulties which occur with a standard d.c. amplifier are overcome by using the signal to be amplified for modulation of a 20 kc/s amplifier in a linear mode. Any additional amplification may then be carried out by an ordinary a.c. amplifier at 20 kc/s. The a.c. output is rectified so that the resulting d.c. component is a replica of the original input. The amplifier described has an overall gain of 100 000.

621.396.692.012.3 **680**

Parallel Standard Resistors.—A. K. W. (*Wireless World*, Dec. 1946, Vol. 52, No. 12, p. 396.) A table is given for finding the value of parallel combinations of standard resistors.

621.397.645 **681**

Video Amplifier H.F. Response : Part 3.—(*Wireless World*, Dec. 1946, Vol 52, No. 12, pp. 413–414.) For parts 1 and 2, see 61 and 62 of January. The circuits there described are combined to form a single coupling having two correcting inductances ; this considerably improves performance.

621.398 **682**

Continuously Variable Radio Remote Control.—D. W. Moore, Jr. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 110–113.) " Phase-shifting properties of a resonant circuit provide automatic self-adjustment of a radio control system. Guided missiles, aircraft, satellite transmitters, and telemetering systems can be radio controlled by the stepless positioning provided."

621.3.011.3 **683**

Introduction au calcul des inductances. [Book Review]—M. Romanowski. Gauthier-Villars, Paris, 114 pp. (*Rev. gén. Élect.*, May 1946, Vol. 55, No. 5, p. 172.) The calculation falls into two stages: (1) application of Maxwell's equations and of the energy laws of linear circuits; (2) integration leading to energy formulae for the whole conductor. The second stage is more particularly concerned in this case. Mathematical difficulties preclude exact solutions except in the simplest cases.

621.319.4 : 621.396.69 (02) **684**

Capacitors — Their Use in Electronic Circuits. [Book Review]—M. Brotherton. D. Van Nostrand, New York, 1946, 107 pp., $3.00. (*Gen. elect. Rev.*, Nov. 1946, Vol. 49, No. 11, pp. 66–67.)

GENERAL PHYSICS

530.13 : 530.12 **685**

Comments on " A Relativistic Misconception ". M. E. Deutsch : V. P. Barton : A. J. O'Leary. (*Science*, 25th Oct. 1946, Vol. 104, No. 2704, pp. 400–401.) The original article was abstracted in 388 of February (Eddy).

530.145 **686**

New Developments in Relativistic Quantum Theory.—C. Møller. (*Nature, Lond.*, 21st Sept. 1946, Vol. 158, No. 4012, pp. 403–406.)

530.145 : 538.3 **687**

Quantum Mechanics of Fields : Part 3 — Electromagnetic Field and Electron Field in Interaction.—M. Born & H. W. Peng. (*Proc. roy. Soc. Edinb. A*, 1944/46, Vol. 62, Part 2, pp. 127–137.) For parts 1 and 2 see 236 of 1945.

534.1 + 535.13] Huyghens **688**

On Huyghens' Principle.—Rocard. (*See* 845.)

535.1 **689**

Waves of Ordinary Light are propagated as if the Luminous Vector were Divergent ; Consequences for Physical Optics.—A. Foix. (*C. R. Acad. Sci., Paris*, 14th Jan. 1946, Vol. 222, No. 3, pp. 180–181.)

535.13 **690**

Mechanical Explanation of Maxwell's Equations.—D. Riabouchinsky. (*C. R. Acad. Sci., Paris*, 8th Oct. 1945, Vol. 221, No. 15, pp. 391–394.) Treatment of Maxwell's equations establishes a univocal and reciprocal correspondence between all the elements of gas-dynamic and electromagnetic fields.

535.13 **691**

Dynamics of the Ether.—D. Riabouchinsky. (*C. R. Acad. Sci., Paris*, 15th Oct. 1945, Vol. 221, No. 16, pp. 432–434.) A system of equations is derived for fluid motion analogous to Maxwell's equations. Continuation of 690 above.

535.312 **692**

Optical Properties of Thin Metallic [non-magnetic] **Laminae.**—F. Scandone & L. Ballerini. (*Nuovo Cim.*, 1st April 1946, Vol. 3, No. 2, pp. 81–115. In Italian with English summary.) Drude's method involving a complex refractive index is applied to derive the classical Fresnel relations and explicit formulae for the intensity and phase relations of the reflected and transmitted energy are obtained.

535.333 : [546.212 + 546.212.02 **693**

Water Spectrum near One-Centimeter Wave-Length.—C. H. Townes & F. R. Merritt. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 558–559.) The spectral lines of H_2O and of mixtures of H_2O and D_2O have been measured at pressures near 0.1 mm Hg using an oscillator whose frequency can be swept across the lines. The frequencies, intensities, and widths of the lines agree with previous measurements at atmospheric pressure within experimental error.

535.736.1 + 771.53 + 621.397.611.2 **694**

A Unified Approach to the Performance of Photographic Film, Television Pickup Tubes, and the Human Eye.—Rose. (*See* 918.)

536.73 **695**

Derivation, Interpretation and Application of the Second Law of Thermodynamics.—P. G. Nutting. (*Science*, 4th Oct. 1946, Vol. 104, No. 2701, pp. 317–318.) The second law is " here derived as a by-product of Gibbs's masterful general treatment, but apparently neither Gibbs nor any of his followers ever noted it."

537 + 538].081.5 **696**

Simplification of the Dimensional Equations of Electric and Magnetic Quantities.—M. Tarbouriech. (*Rev. gén. Élect.*, April 1946, Vol. 55, No. 4, pp. 151–155.) Tables are given showing the further simplification of the dimensional system of Brylinski (4023 of 1944) (*a*) when Q is replaced by IT and LT^{-1} by V in the equations involving I, L and T, and (*b*) when the quantities involved are R, I, T and L. The advantages of the latter system are enumerated.

537.291 **697**

Graphical Determination of Electron Trajectories in a Given Electric Field.—R. Musson-Genon. (*C. R. Acad. Sci., Paris,* 8th April 1946, Vol. 222, No. 15, pp. 858–860.) The determination of planar electron trajectories, when the potential is known, is effected generally by a graphical construction analogous to Huyghens' method in optics. The accuracy normally achieved by this method is discussed and a method of correction indicated which increases it.

537.311.33 **698**

Relation between the Constant A and the Thermal Activation Energy ε in the Conductivity Law of Semiconductors.—G. Busch. (*Helv. phys. Acta,* 31st May 1946, Vol. 19, No. 3, pp. 189–198.) Wilson's theory of excess semiconductors is extended assuming that the location of the electron distribution centres in the energy scheme is not given by a discrete value ΔB of the thermal activation energy ϵ, but by a region of finite breadth. For the conductivity σ two temperature regions exist in which $\log \sigma$ is a linear function of the reciprocal of the absolute temperature, the two slopes being different. Application of the theory of lattice defects in crystals to the semiconductor problem shows the empirical relation $\log A = \alpha + \beta\epsilon$ between the constant A and the thermal activation energy ϵ to be exactly valid.

537.52 **699**

On the Mechanism of the Progress of a Discharge.—A. Zingerman & N. Nikolaevskaya. (*Zh. eksp. teor. Fiz.,* 1946, Vol. 16, No. 6, pp. 499–502. In Russian.) Photographs were taken of incomplete discharges between two spheres separated by distances of several hundred millimetres. Impulse voltages up to 3 MV were applied to the spheres. It appears from these photographs that the discharge channel is not formed by the movement from the cathode to the anode of a single 'electron avalanche' but consists of several merging streams. The speed of the growth of the 'electron avalanche' is discussed and two typical photographs are shown.

537.523.4 **700**

Phenomena of Voltage Recovery in V.H.F. Sparks.—S. Teszner. (*C. R. Acad. Sci., Paris,* 1st Oct. 1945, Vol. 221, No. 14, pp. 373–375.) The phenomena are explained on the assumption that thermionic emission from the electrodes can be neglected in practice.

537.533.74 **701**

Reaction of Radiation on Electron Scattering and Heitler's Theory of Radiation Damping.—H. A. Bethe & J. R. Oppenheimer. (*Phys. Rev.,* 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 451–459.)

537.565 **702**

The Mobility and Diffusion of Ions.—É. Montel. (*C. R. Acad. Sci., Paris,* 8th April 1946, Vol. 222, No. 15, pp. 873–875.) If I is the current varying with period T represented by identical ions, of mobility k, introduced into a plane condenser at the level of one of the plates, i the current collected by the other plate when a constant p.d. $V = ha$ is maintained between the armatures, a being their distance apart, then neglecting diffusion and supposing the space density is small enough to produce no deformation of the field, i has a zero minimum value every time the wavelength khT/m of the harmonic of order m is contained an integral number of times in a. When account is taken of ionic diffusion it is shown that the effect on the position of these minima is completely negligible and so cannot influence values of k determined from them.

538.23 + 538.541 **703**

Simple Relation between the Energies dissipated by Hysteresis and Eddy Currents in a Solid of Revolution.—G. Ribaud. (*C. R. Acad. Sci., Paris,* 1st April 1946, Vol. 222, No. 14, pp. 788–789.) Calculations of the energy dissipation made for different solids of revolution, assuming that the frequency is high enough for the skin thickness to be small and the field weak enough for the permeability to be considered constant. In all cases it is found that the ratio of hysteresis loss to that due to eddy currents is the same and equal to $1/\pi$ of the area of the B, H cycle for $H = 1$.

538.3 **704**

The Interpretation of Maxwell's Equations.—L. Bouthillon. (*C.R. Acad. Sci., Paris,* 8th April 1946, Vol. 222, No. 15, pp. 871–873.) It is shown that Maxwell's equations can be written in the form :

$$-[\overline{\nabla}\,\overline{\mathrm{D}}] = \frac{4\pi}{a_e}\,\bar{j} + \overline{\frac{\partial \mathrm{H}}{\partial t}} \qquad [\overline{\nabla}\,\overline{\mathrm{B}}] = \frac{4\pi}{a_m}\,\bar{i} + \frac{\partial \overline{\mathrm{E}}}{\partial t},$$

$$(\overline{\nabla}\,\overline{\mathrm{E}}) = \frac{4\pi}{k_e}\,\rho \qquad (\overline{\nabla}\,\overline{\mathrm{H}}) = \frac{4\pi}{k_m}\,\mu.$$

Thus each term in the equations on the left has its counterpart in those on the right. $-\overline{\mathrm{B}}$, the magnetic induction, corresponds to $\overline{\mathrm{D}}$, the electric induction, and vice versa ; $\overline{\mathrm{H}}$, the intensity of the magnetic field, to $\overline{\mathrm{E}}$, the intensity of the electric field ; $\bar{j}$, the intensity of the magnetic current, to $\bar{i}$, that of the electric current, and μ, the magnetic charge, to ρ, the electric charge. Written in this way, Maxwell's equations have maximum symmetry.

538.566.2 + 534.222.1 **705**

Propagation of Radiation in a Medium with Random Inhomogeneities.—Bergmann. (*See* 847.)

538.691 : 513.738 **706**

Geometrical Characterizations of Some Families of Dynamical Trajectories.—L. A. MacColl. (*Bell Syst. tech. J.,* Oct. 1946, Vol. 25, No. 4, p. 653.) A solution of the problem of "obtaining a set of geometrical properties which shall completely characterize the 5-parameter family of trajectories of an electrified particle moving in an arbitrary static magnetic field." Abstracted from *Amer. math. Soc. Trans.,* July 1946.

539.133 **707**

A New Method of Measuring the Electric Dipole Moment and Moment of Inertia of Diatomic Polar Molecules.—H. K. Hughes. (*Phys. Rev.,* 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 570–571.) Preliminary results of experiments on the behaviour of molecules subjected simultaneously to a steady homogeneous electric field and an oscillating electric field mutually at right angles.

539.15 **708**

Nuclear Magnetic Resonance and Spin Lattice Equilibrium.—B. V. Rollin. (*Nature, Lond.,* 9th Nov. 1946, Vol. 158, No. 4019, pp. 669–670.) Measurement of r.f. absorption of a material in a magnetic field gives the time for establishment of thermal equilibrium between the spin system and the lattice. Measurable absorptions have been observed so far only with substances containing protons or fluorine nuclei.

539.152.1 **709**

The Principles of Nuclear Physics.—L. Bloch. (*Rev. gén. Élect.*, Jan. 1946, Vol. 55, No. 1, pp. 31–35.)

539.16.08 **710**

An Arrangement with Small Solid Angle for Measurement of Beta Rays.—L. F. Curtiss & B. W. Brown. (*Bur. Stand. J. Res.*, Aug. 1946, Vol. 37, No. 2, pp. 91–94.)

539.23 **711**

[Optical] **Anti-Reflexion and High-Reflexion Films.**—S. Weintroub. (*Nature, Lond.*, 21st Sept. 1946, Vol. 158, No. 4012, p. 422.) Describes some of the properties of single-layer films of high refractive index and optical thickness $\frac{1}{4}$ of the mean wavelength of the incident light, and of multi-layer films of alternately low and high refractive index.

541.133 **712**

On the Conductivity of Strong Electrolytes.—S. G. Chaudhury. (*J. phys. Chem.*, Nov. 1946, Vol. 50, No. 6, pp. 477–485.) An equation relating conductivity and concentration, derived by Onsager and modified by Shedlovsky, neglects " the effect of the change in the concentrations of ions near the electrode surface (during the time the current is on) from those in the bulk on the conductivities or mobilities of ions ". This effect is considered and an equation for the conductivity deduced.

541.135 **713**

Research on the Mechanism of Electrolysis. Study of the Energy Transfer Coefficients.—M. Bonnemay. (*C. R. Acad. Sci., Paris*, 1st April 1946, Vol. 222, No. 14, pp. 793–795.)

546.33-16 + 546.171.1-16] : 621.3.02 **714**

Persistent Currents in Frozen Metal-Ammonia Solutions.—J. W. Hodgins. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, p. 568.) Persistent currents up to 0.1 A lasting for as much as 30 sec have been detected in frozen rings of sodium solutions in liquid ammonia. Currents were detected by means of a search coil and ballistic galvanometer. The presence of persistent currents appeared to depend critically on the temperature cycle involved.

621.385.1.016.4.029.5 **715**

Production of High-Frequency Energy by an Ionized Gas.—P. C. Thonemann & R. B. King. (*Nature, Lond.*, 21st Sept. 1946, Vol. 158, No. 4012, p. 414.) By coupling a coaxial line into a discharge tube near the anode and suitably adjusting an external bar magnet, an output corresponding to 3 mV could be obtained at the output of a 1 000-Mc/s superheterodyne receiver of 4 Mc/s bandwidth. No input was observed in the cathode region or in the absence of the magnet.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.72.029.62 **716**

Temperature Radiation from the Quiet Sun in the Radio Spectrum.—D. F. Martyn. (*Nature, Lond.*, 2nd Nov. 1946, Vol. 158, No. 4018, pp. 632–633.) The undisturbed sun can be considered as a radiator having maximum effective temperature of the order of 10^6 degrees Kelvin at about $\lambda = 1$ m. For $\lambda < 1$ m the radiation emanates from the cooler chromosphere while for $\lambda > 1$ m the corona tends to behave as a reflector. The temperatures observed are consistent with Edlén's estimate of 10^6 degrees for the coronal temperature. It is predicted that for $\lambda > 1$ m there should be a progressive reduction of brightness as the limb is approached but at wavelengths below 60 cm there should be a limb brightening (Fig. 2). The effect of the solar magnetic field is illustrated in Fig. 1 where the estimated effective temperature/wavelength distribution for both ordinary and extraordinary radiation is shown.

523.72.029.62 **717**

Observation of Million Degree Thermal Radiation from the Sun at a Wavelength of 1.5 Metres.—J. L. Pawsey. (*Nature, Lond.*, 2nd Nov. 1946, Vol. 158, No. 4018, pp. 633–634.) Daily measurements of solar noise over a period of 6 months on λ 1.5 m confirm Martyn's predictions of thermal radiation at temperatures of the order of 10^6 degrees Kelvin (see 716). Histograms of the results show a sharp cut-off at a lower limit corresponding to 0.6 – 1.2 × 10^6 degrees ; the skewness of the curve at high intensities may be explained by variable additional radiation associated with sunspots.

537.591 **718**

Momentum Spectrum of Mesons at Sea-Level.—J. G. Wilson. (*Nature, Lond.*, 21st Sept. 1946, Vol. 158, No. 4012, pp. 414–415.)

537.591 **719**

Observations of Protons of Great Energy in the Penetrating Part of Cosmic Radiation.—L. Leprince-Ringuet, M. Lhéritier & R. Richard-Foy. (*C.R. Acad. Sci., Paris*, 8th Oct. 1945, Vol. 221, No. 15, pp. 406–407.)

537.591 : [546.621 + 546.815 **720**

A Comparison of the Stopping Power of Lead and Aluminium for Cosmic-Ray Mesotrons.—E. Fein. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, p. 567.)

537.591 : 550.385 **721**

Changes in Cosmic Ray Intensity associated with Magnetic Storms.—H. Alfvén. (*Nature, Lond.*, 2nd Nov. 1946, Vol. 158, No. 4018, pp. 618–619.) These may be due to changes in the earth's electrostatic potential caused by differences in potential between the two sides of the ion stream emitted by the sun at the time of a storm. This potential difference may amount to 50 MV and is due to motion of the ion stream in the sun's magnetic field.

537.591.1 **722**

Observations of Remarkable Particles Other than Protons in the Penetrating Part of Cosmic Radiation.—L. Leprince-Ringuet, M. Lhéritier & R. Richard-Foy. (*C. R. Acad. Sci., Paris*, 22nd Oct. 1945, Vol. 221, No. 17, pp. 465–467.) Trajectories observed in a large Wilson chamber differ from those due to protons or mesons. A particle intermediate between the two would explain satisfactorily the observed results, which are compatible with the emission of a neutral meson.

538.71.087 **723**

Monitor for Magnetic Storms.—A. Dauvillier. (*C. R. Acad. Sci., Paris,* 12th June 1946, Vol. 222, No. 24, pp. 1380–1381.) Describes apparatus installed at the Pic du Midi observatory to give audible warning of large variations of the horizontal component of the earth's magnetic field.

550.38(44) " 00/04 " **724**

Intensity of the Terrestrial Magnetic Field in France in the Gallo-Roman Period.—É. Thellier & O. Thellier. (*C. R. Acad. Sci., Paris,* 8th April 1946, Vol. 222, No. 15, pp. 905–907.) Measurements on samples from the Fréjus amphitheatre and the Cluny thermal baths have given mean values of 0.66 and 0.71 gauss respectively for the earth's field in ancient times. These results are discussed.

550.385 " 1946.03.28 " **725**

Exceptional Magnetic Disturbance of 28th March 1946.—G. Gibault. (*C. R. Acad. Sci., Paris,* 8th April 1946, Vol. 222, No. 15, pp. 907–908.)

551.510.535 **726**

High-Power Radio Soundings of the Ionosphere.—P. Lejay & R. Chezlemas. (*C.R. Acad. Sci., Paris,* 12th June 1946, Vol. 222, No. 24, pp. 1363–1366.) A report of results obtained, every two hours in the daytime, since April 1946, at the National Radio Laboratory, Bagneux (Seine). Rectangular pulses, of duration 20 μs, were transmitted 50 times per second from each of two self-oscillators giving about 20 kW aerial power, one covering 3.5–6.5 Mc/s and the other 6.5–11.5 Mc/s, the sweep being completed in about 15 min. The photographic records show that the critical frequencies for reflection from the F_2 layer are considerably higher than those expected on theoretical grounds and than those observed elsewhere. The mean values for April were about 2 Mc/s higher than those predicted by American forecasts. Slow changes were noted, low values for the critical frequencies on April 7 and 14 being followed by high values on April 9 and 16–17 respectively. Low values correspond in general to greater equivalent heights.

551.510.535 **727**

Nocturnal Variations of the Heights of the Layers of Maximum Ionisation of Regions *E* and *F*.—S. N. Ghosh. (*Sci. Culture,* Oct. 1946, Vol. 12, No. 4, pp. 201–202.) The height of the layer of maximum electron density in the E layer remains fairly constant during the night while the corresponding height for the F layer increases. This fact is explained theoretically as being due to the different laws of disappearance of free electrons in the two regions.

551.510.535 : 550.38 **728**

Geomagnetic Control of Region F_2 of the Ionosphere.—S. K. Mitra. (*Nature, Lond.,* 9th Nov. 1946, Vol. 158, No. 4019, pp. 668–669.) Discussion of Appleton's recent note (2898 of 1946). The geomagnetic effects may arise from bombardment of the upper atmosphere by charged particles but it is more likely that the particles are of terrestrial origin and ionized by solar ultra-violet rays. This hypothesis is consistent with Appleton's experimental data and with the geomagnetic control of the intensity of night-sky radiation.

551.510.535 : 550.384.4 **729**

Geomagnetic Time Variations and Their Relation to Ionospheric Conditions.—S. K. Chakrabarty. (*Curr. Sci.,* Sept. 1946, Vol. 15, No. 9, pp. 246–247.) The quiet day solar diurnal variation S_q of the geomagnetic field is believed to originate in the earth's outer atmosphere or the ionosphere. S_q curves of San Juan, Alibag, and Huancayo are given. For low latitude stations variations of S_q appear to depend on geomagnetic parameters, although for high latitude stations they depend more on geographical coordinates.

These results can be explained if the atmospheric conductivity K is supposed to vary with geomagnetic latitude, particularly for low latitudes, and if K is not dependent on the sun's zenith distance as has previously been assumed. The probable source of the S_q current system is the F_2 layer.

551.515.42 **730**

On the Development of Microcyclones below Thunder Clouds.—S. Mull & Y. P. Rao. (*Sci. Culture,* Aug. 1946, Vol. 12, No. 2, pp. 106–108.) An expression is derived for the pressure fall below a thunder cloud. This explains the existence of small kinks in the isobars, before the development of a major thunderstorm.

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 523.2 : 621.396.1 **731**

Astronomical Radar.—In 106 of January please cancel the words 'using a parabolic aerial array'.

621.396.931/.933].22.029.62 **732**

Radio Direction Finding at 1.67-Meter Wavelengths.—L. C. L. Yuan. (*Proc. Inst. Radio Engrs, W. & E.,* Oct. 1946, Vol. 34, No. 10, pp. 752–756.) Describes 1.67 m tests on various aerial systems for measuring both the elevation and bearing of an incident wave. Measurements were made at ranges from 7 to 30 miles. With the aerial system 1.5 λ above ground, and with a dry surface free from reflecting objects, the results agree with the optical direction for the incident wave to within $\frac{1}{2}°$ in bearing, and to within $\pm\frac{1}{2}°$ in elevation. With wet ground the error in the elevation may be as great as $3\frac{3}{4}°$. A mathematical analysis of the reception by the two aerial systems used is given.

621.396.932.1 **733**

New Techniques in Modern Marine Navigation.—R. Leprêtre. (*Rev. gén. Élect.,* Nov. 1946, Vol. 55, No. 11, pp. 419–426.) A general account of the application of radar to marine navigation and a more detailed account of the operation of the Decca system.

621.396.933 **734**

The Radio Equipment used by the Pilot of an Aircraft and the Corresponding Ground Installations.—Gaillard. (*See* 887.)

621.396.933 **735**

An Introduction to Hyperbolic Navigation, with Particular Reference to Loran.—J. A. Pierce. (*J. Instn elect. Engrs,* Part I, Nov. 1946, Vol. 93, No. 71, pp. 546–547.) A longer abstract of the same paper was noted in 3287 of 1946.

621.396.933.1 **736**

Simple Radio Approach System.—R. Besson. (*Toute la Radio,* March/April 1946, Vol. 13, No. 104, pp. 84–85.) A coil is carried by the aircraft in a plane perpendicular to the axis of the fuselage, with a vertical aerial just behind the coil and a suitable receiver whose output feeds a bridge type rectifier associated with a centre-zero voltmeter. A motor driven commutator reverses the coil connexions every 1/12 sec and at the same time reverses the voltmeter connexions. With the aircraft on its proper course the voltmeter needle points to zero, deviations being indicated by movement of the needle to either side.

621.396.96 + 621.396.932 **737**

SJ Radar for Submarines.—C. L. Van Inwagen. (*Bell Lab. Rec.,* Nov. 1946, Vol. 24, No. 11, pp. 402–406.) A 3 000-Mc/s radar for location of ship target by submarines, with p.p.i. and A-scope displays. It can also be used as an aid to navigation.

621.396.96 **738**

Scanning Equipment for Ground Radar.—D. Taylor & W. H. Penley. (*Engineering, Lond.,* 11th Oct. 1946, Vol. 162, No. 4213, pp. 337–338.) The motions of two aerial systems may be synchronized by using (*a*) two identical three-phase induction motors with stators in parallel and wound rotors in parallel; (*b*) three selsyns as a differential mechanism to operate an oil pump and oil motor; and (*c*) two selsyns operating a Ward-Leonard control unit through a thermionic-valve torque amplifier. The last method gave the smoothest control and with 1-h.p. motors two arrays were synchronized within ± 1°. A dipole-rocking mechanism is described in which the dipole is at the end of a pivoted arm which is rocked by means of a special arrangement of two crankshafts using weights to provide mechanical balance.

621.396.96 **739**

Radio v. U-Boat.—G. M. Bennett. (*Wireless World,* Dec. 1946, Vol. 52, No. 12, pp. 408–411.) An account of the development of radio detecting devices used by allied aircraft and ships in the Battle of the Atlantic and the countermeasures adopted by the enemy.

621.396.96 : 011.4 **740**

What is Radar?—" Cathode Ray ". (*Wireless World,* Dec. 1946, Vol. 52, No. 12, pp. 415–416.) A discussion of the various definitions that have been given of radar, pointing out the techniques covered by each definition.

621.396.96 **741**

The Battle of the Atlantic. [Book Notice]—Central Office of Information, London, 104 pp., 1s. (*Govt Publ., Lond.,* Oct. 1946, p. 3.) The official account of the fight against the U-Boats, 1939–1945.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **742**

What is a Vacuum?—H. Piraux. (*Toute la Radio,* July/Aug. 1946, Vol. 13, No. 107, pp. 189–193.) A review of methods of obtaining and measuring high vacua.

535.377 **743**

The Thermoluminescence and Conductivity of Phosphors.—R. C. Herman & C. F. Meyer. (*J. appl. Phys.,* Sept. 1946, Vol. 17, No. 9, pp. 743–748.) Phosphors such as zinc sulphide irradiated by ultraviolet at low temperatures can be made to glow by raising the temperature, the electrical conductivity rising at the same time. A theoretical discussion of these phenomena is given.

537.13 : 621.385.1.032.216 **744**

Some Cases of Interaction between Positive Ions and Metallic Surfaces.—N. Morgulis. (*Zh. eksp. teor. Fiz.,* 1946, Vol. 16, No. 6, pp. 489–494. In Russian.) An experimental attempt to determine the contact potential differences of thoriated tungsten by observing the displacement of the ion current characteristics for different thorium coatings and different conditions of thermal ionization did not produce satisfactory results.

In experimental investigations of this kind the neutralization of the ions on the surface is often slowed down, but the electric field prevents the ions from leaving the surface. This phenomenon is discussed for the case of a pure tungsten filament in caesium vapour, and conditions of equilibrium are established.

537.311.33 : 546.281.26 **745**

Electric Conductivity of Silicon Carbide.—G. Busch. (*Helv. phys. Acta,* 31st May 1946, Vol. 19, No. 3, pp. 167–188.) Conductivity measurements on single crystals of silicon carbide for current densities between 10^{-5} A/sq. cm and about 1 A/sq. cm show Ohm's law to be valid. Curves are given showing the variation of conductivity with temperature from 80°K to 1 400°K.

537.533.8 **746**

Secondary Emission from Germanium, Boron, and Silicon.—L. R. Koller & J. S. Burgess. (*Phys. Rev.,* 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, p. 571.) The experiments were carried out in an electron gun tube evacuated to between 10^{-6} and 10^{-7} mm Hg. The germanium and silicon were heated to dull red heat and the boron to 425°C before making measurements. Results are shown graphically.

538.221 **747**

Anomalous High-Frequency Resistance of Ferromagnetic Metals.—J. H. E. Griffiths. (*Nature, Lond.,* 9th Nov. 1946, Vol. 158, No. 4019, pp. 670–671.) At λ 1–3 cm the product $\mu\rho$ of the permeability and resistivity of ferromagnetic films shows a large increase at a certain value of external steady magnetic field H. If H^1 is the magnetic field inside the metal, the product $H^1\lambda$ tends to be constant and is of the order of $2\pi mc/e$ ($= 10.7 \times 10^3$ gauss/cm.) This suggests that resonant absorption by magnetic dipoles is taking place.

538.221 **748**

Magnetic Dispersion of Iron Oxides at Centimetre Wave-Lengths.—J. B. Birks. (*Nature, Lond.,* 9th Nov. 1946, Vol. 158, No. 4019, pp. 671–672.) Measurements were made of the characteristic impedance and propagation constant of a coaxial line (at λ 9 and 6 cm) and of a waveguide (at λ 3 cm) filled with mixtures of ferroso-ferric or gamma-ferric oxide and paraffin wax. The complex permeability of each oxide was deduced; its magnitude decreases rapidly with the wavelength and a large absorption occurs.

538.221 **749**

Magnetic Properties of Feebly Magnetic Sesquioxide of Iron.—J. Roquet. (*C. R. Acad. Sci., Paris*, 25th March 1946, Vol. 222, No. 13, pp. 727–729.)

546.287 **750**

Silicone Oils : Part 1 — Their Properties.—D. F. Wilcock. (*Gen. elect. Rev.*, Nov. 1946, Vol. 49, No. 11, pp. 14–18.) Description of chemical constitution, viscosity in relation to temperature, pour point, evaporation, miscibility, combustion, and some chemical properties.

546.841.78 : 621.385.032.21 : 539.16.08 **751**

A Geiger Counter for Determination of Thorium Content of Thoriated-Tungsten Wire.—R. E. Aitchison. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 1–5.)

548.0 : 537 : 546.331.2 **752**

Elastic, Piezoelectric, and Dielectric Properties of Sodium Chlorate and Sodium Bromate.—W. P. Mason. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 529–537.) Determination over a wide temperature range by measuring the properties for three oriented cuts. Values of piezoelectric constant and Poisson's ratio obtained differ considerably from those of previous workers.

548.4 **753**

Imperfections in the Structure of Large Metal Crystals, revealed by Micrography and by X Rays.—P. Lacombe & L. Beaujard. (*C. R. Acad. Sci., Paris*, 8th Oct. 1945, Vol. 221, No. 15, pp. 414–416.)

549.514.51 + 549.614] : 548.4 **754**

Surface Layers on Quartz and Topaz.—D. D'Eustachio. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 522–528.) An investigation, by X-ray photography, of the nature of the surface layers of single crystals of quartz and topaz.

621.314.632 **755**

Phenomena of Aging of Copper Oxide Rectifiers.—R. Douçot. (*Rev. gén. Élect.*, Nov. 1946, Vol. 55, No. 11, pp. 448–451.) Results of an experimental study are given graphically. Aging is rapid in the days immediately following manufacture and can be accelerated by special treatment. The d.c. characteristic has a point of maximum stability at about 0.3 V. This is of importance in carrier-current telephony, where the rectifier is used at a particular point of its characteristic.

621.315.33 **756**

The Inside of Electrical Machines [manufacture and insulation of copper wire and strip].—R. H. Robinson. (*Electrician*, 20th Sept. 1946, Vol. 137, No. 3564, pp. 787–791.) An account of the drawing and covering of copper wire with a short discussion of the dielectric strength of various coverings.

621.315.61 : 537.533.73 **757**

Study of Insulating Materials by Electron Diffraction.—J. Devaux. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 324–326.) Charge which accumulates on the specimen can be dispelled by playing on it a secondary beam of electrons of low velocity. This is due to ionization by the slow electrons of the residual gas in the discharge tube. The value of using X-ray and electron diffraction methods in the study of crystals is outlined.

621.315.61 : 679.5 **758**

New Electrical Materials : Part 2.—A. E. L. Jervis. (*Electrician*, 20th Sept. 1946, Vol. 137, No. 3564, pp. 793–797.) Continuation of 2931 of 1946. Notes on silicones and their use in ceramics, resins, greases and enamels. An extensive bibliography is appended.

621.315.612 **759**

High Dielectric Constant Ceramics.—A. von Hippel, R. G. Breckenridge, F. G. Chesley & L. Tisza. (*Industr. Engng Chem.*, Nov. 1946, Vol. 38, No. 11, pp. 1097–1109.) Dielectric measurements over a wide range of frequencies, temperatures and voltages, and thermal expansion and X-ray studies, were undertaken for titanium dioxide and the alkaline earth titanates, including some mixtures and solid solutions of the barium and strontium compounds. Barium titanate and the barium-strontium titanate solid solutions exhibit peculiar dielectric behaviour which is connected with a lattice transition from pseudocubic to cubic.

621.315.614.72.011.5 **760**

Dielectric Strength Measurements on Varnished Cambric.—A. Rufolo & H. K. Graves. (*ASTM Bull.*, Oct. 1946, No. 142, pp. 34–37.) A study of the effect of humidity, electrodes, and breakdown media on dielectric strength.

621.315.615 : 679.5 **761**

Dielectric Constants of Dimethyl Siloxane Polymers.—E. B. Baker, A. J. Barry & M. J. Hunter. (*Industr. Engng Chem.*, Nov. 1946, Vol. 38, No. 11, pp. 1117–1120.) The dielectric constants of these silicones were measured as functions of temperature. The results, together with density/temperature and optical data, were used to calculate the dipole moments, the infra-red dispersion and the dipole, atomic and electronic polarizations by means of the Onsager-Kirkwood theory.

621.315.616 : 679.5 **762**

Plastic Compositions for Dielectric Applications.—W. C. Goggin & R. F. Boyer. (*Industr. Engng Chem.*, Nov. 1946, Vol. 38, No. 11, pp. 1090–1096.) Plastics are described for use as casting and laminating resins and for sealing components. For radar housings polystyrene fibres were used. A sandwich method using hard outer surfaces filled with polystyrene foam gave low loss at very high frequencies. The housings for proximity fuses and the materials used in cables present special problems. The characteristics of an experimental plastic having rigidity and ideal electrical properties are given.

621.315.616.029.5 : 679.5 **763**

Polystyrene Plastics as High Frequency Dielectrics.—A. von Hippel & L. G. Wesson. (*Industr. Engng Chem.*, Nov. 1946, Vol. 38, No. 11, pp. 1121–1129.) The dielectric loss in styrene monomer is analysed. Polymerization conditions are investigated and a high quality polystyrene is modified by cross-linking, copolymerization and hydrogen substitution. Special filters allow adjustment of the dielectric constant and the thermal expansion (for sealing to metal surfaces).

621.315.616.9.015.5 **764**

The Electric Strength of Paraffins and Some High Polymers.—A. E. W. Austen & H. Pelzer. (*J. Instn elect. Engrs,* Part I, Nov. 1946, Vol. 93, No. 71, pp. 525–532.) Attempts to measure the electric strength of paraffins were unsuccessful, except for material oriented by pressing. A value of 6.5×10^6 V/cm was obtained for polythene, with little change from room temperature to −190°C. The strength of polyvinyl chloride-acetate increased from 6.5×10^6 V/cm at room temperature to 12×10^6 V/cm at −190°C.

621.316.89 + 621.315.59 **765**

Properties and Uses of Thermistors — Thermally Sensitive Resistors.—J. A. Becker, C. B. Green & G. L. Pearson. (*Trans. Amer. Inst. elect. Engrs,* Nov. 1946, Vol. 65, No. 11, pp. 711–725.) A detailed discussion of the conduction mechanism in semiconductors, and the criteria for usefulness of circuit elements made from them. Methods of preparation, and numerous applications of thermistors using their high temperature coefficient of resistivity are given.

621.316.89.029.63 **766**

Thermistors at High Frequencies.—J. Walker. (*Wireless Engr,* Jan. 1947, Vol. 24, No. 280, pp. 28–29.) Measurements made on the resistance of a directly heated high resistance thermistor at 400 Mc/s are in agreement with values calculated from a knowledge of the d.c. resistance.

621.318.32 : 621.317.44 **767**

New Method for the Study of Ferromagnetic Materials in Weak A.C. Fields. Application to Some Alloys.—Épelboïm. (*See* 797.)

621.357.8 : 537.533.73 **768**

Diffraction of Electrons at Monocrystalline Surfaces of Electrolytically Polished Copper.—P. Renaud & H. Frisby. (*C. R. Acad. Sci., Paris,* 17th June 1946, Vol. 222, No. 25, pp. 1429–1430.) For the metallurgical or electrochemical study of metals it is very desirable to use well-defined and reproducible surfaces which, as far as possible, correspond to the true crystal lattice. Polished copper surfaces were prepared electrolytically. The bath must be protected from dust particles and it is desirable to calcine the anode and cathode before use. Excellent diffraction photographs were obtained with such surfaces after treatment with boiling water. The diagrams correspond to Cu_2O and suggest that the electrons penetrate a large number of layers; they cannot be explained in terms of diffraction by a few layers of atoms only. The electrolytically polished copper surfaces are attacked when cold by distilled water.

621.357.8 : 548.73 **769**

X-Ray Study of the Surface Hardening of Single Crystals of Aluminium and of Iron by Mechanical Polishing.—J. Bénard & P. Lacombe. (*C. R. Acad. Sci., Paris,* 14th Jan. 1946, Vol. 222, No. 3, pp. 182–183.) To determine the depth of the structural modification due to polishing with emery, electrolytic polishing of the successive layers was used and a study made of the changes in the X-ray reflection diagrams. Beyond a certain depth (5 to 10 μ for No. 2 emery) the original pattern of Laue spots and continuous Debye-Scherrer rings changed, the rings becoming sectors only and disappearing altogether, leaving only the Laue spots, at a depth of the order of 60 μ. The results for aluminium were similar, but the depth of modification was considerably less than for iron.

621.362 **770**

Characteristics of Thermocouples.—Weller. (*See* 815.)

621.385.832.087.5 **771**

A New Film for Photographing the Television Monitor Tube.—White & Boyer. (*See* 907.)

621.791.76 : 621.3.011.2 **772**

Measurement and Effect of Contact Resistance in Spot Welding.—R. A. Wyant. (*Trans. Amer. Inst. elect. Engrs,* June Supplement 1946, Vol. 65, p. 513.) Discussion of 1890 of 1946.

621.798 : 679.5 **773**

Polythene Plastics for Packaging.—Visking Corporation. (*Materials & Methods,* Nov. 1946, Vol. 24, No. 5, pp. 1188–1189.)

621.9.038 **774**

Dies from Diamonds and Their Use : a Triumph of Technical Precision.—C. C. Paterson. (*Not. Proc. roy. Instn,* 1946, Vol. 33, No. 150, pp. 14–21.)

666.1.031.13 **775**

Physical Basis of the Electrical Fusion of Glass.—I. Peychès. (*Rev. gén. Élect.,* April 1946, Vol. 55, No. 4, pp. 143–150.) The difficulties encountered in the fusion of glass by the passage through it of electric currents are due to the wide variation of resistance with temperature, low heat conductivity and high viscosity. These are discussed from a practical standpoint.

666.115 : [532.13 + 536.4 **776**

Viscosity and the Extraordinary Heat Effects in Glass.—A. Q. Tool. (*Bur. Stand. J. Res.,* Aug. 1946, Vol. 37, No. 2, pp. 73–90.)

666.29.041 **777**

Automatic Glazing Machine.—R. Rulison. (*Bell Lab. Rec.,* Nov. 1946, Vol. 24, No. 11, pp. 400–401.) The rods to be glazed are mounted on a slowly rotating shaft placed inside an electrically heated furnace.

669.738 **778**

Cadmium Plate and Passivated Cadmium-Plate Coatings.—E. E. Halls. (*Metallurgia, Manchr,* Oct. 1946, Vol. 34, No. 204, pp. 295–297.)

669.738 **779**

Cadmium Plate and Passivated Cadmium-Plate Coatings.—F. Taylor: E. E. Halls. (*Metallurgia, Manchr,* Nov. 1946, Vol. 35, No. 205, pp. 28–31.) Comment on 778 above, and Halls' reply.

678 **780**

Comparison of Natural and Synthetic Hard Rubbers.—G. G. Winspear, D. B. Herrmann, F. S. Malm & A. R. Kemp. (*Bell Syst. tech. J.,* Oct. 1946, Vol. 25, No. 4, p. 654.) Abstracted from *Industr. Engng Chem.,* July 1946.

621.31 **781**

Electrical Contacts. [Book Review]—L. B. Hunt. Johnson & Matthey, London, 1946, 122 pp., 10s. 6d. (*Nature, Lond.,* 9th Nov. 1946, Vol. 158, No. 4019, p. 647.) A book of reference for the electrical engineer, written in collaboration with others. The subject is dealt with under three headings: design and selection of contacts, properties of contact materials and contact engineering.

666.1 (02) **782**

Techniques of Glass Manipulation in Scientific Research. [Book Review]—J. D. Heldman. Prentice-Hall, New York, 1946, 132 pp., $2.50. (*J. phys. Chem.*, Nov. 1946, Vol. 50, No. 6, p. 489.)

MATHEMATICS

517.432.1 **783**

On the Operator Formulae of the Symbolic Calculus.—P. Humbert. (*C. R. Acad. Sci., Paris*, 8th Oct. 1945, Vol. 221, No. 15, pp. 398–399.) Distinguishes three classes of operational formulae, of which the third has been very little studied. Examples are given.

517.512.2 **784**

Fourier Analysis of Frequency-Modulated Oscillations with Saw-Tooth Variation of the Instantaneous Frequency.—J. Rybner. (*Akad. tekn. Videnskab., Lydtekn. Lab.*, Publ. No. 2: Reprint from *Matemat. Tidskr. Afd. B*, 1946. In Danish with English summary.) The oscillation is $a = A \sin (\omega t + f.\delta\omega.t^2])$ where t lies between $\pm 1/2f$. The carrier-frequency components can be expressed in terms of Fresnel integrals. The sideband components cannot be expressed in terms of fully tabulated functions, but values are given for the first four terms for a range of about 1–10 of modulation index.

517.942.9 **785**

The Numerical Solution of Laplace's Equation in Composite Rectangular Areas.—M. M. Frocht. (*J. appl. Phys.*, Sept. 1946, Vol. 17, No. 9, pp. 730–742.)

517.948.32 **786**

The Principal Methods of Solving Numerically the Integral Equations of Fredholm and Volterra.—J. Bernier. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 311–318.) These equations occur in numerous boundary-condition problems.

518.5 **787**

The Automatic Sequence Controlled Calculator: Part 3.—H. H. Aiken & G. M. Hopper. (*Elect. Engng, N.Y.*, Nov. 1946, Vol. 65, No. 11, pp. 522–528.) For parts 1 and 2 see 461 of February.

518.5 **788**

A Punched-Card Technique for Computing Means, Standard Deviations, and the Product-Moment Correlation Coefficient and for Listing Scattergrams.—N. R. Bartlett. (*Science*, 18th Oct. 1946, Vol. 104, No. 2703, pp. 374–375.)

51(075.8) **789**

Higher Mathematics for Students of Chemistry and Physics, with Special Reference to Practical Work.—[Book Review]—J. W. Mellor. Dover Publications, New York, 1946, 641 pp., $4.50. (*Gen. elect. Rev.*, Nov. 1946, Vol. 49, No. 11, p. 67.) The purpose is "to give a working knowledge of higher mathematics to students of physical and general chemistry". A special feature is the large number of examples based on actual measurements published in current scientific articles.

MEASUREMENTS AND TEST GEAR

621.316.89.029.63 **790**

Thermistors at High Frequencies.—Walker. (*See* 766.)

621.317.32 : 537.533.73 **791**

Measurement of High D.C. Voltages by Electron Diffraction.—J. J. Trillat. (*Rev. gén. Élect.*, Aug. 1946, Vol. 55, No. 8, pp. 307–310.) By means of electrons with uniform velocity, measurements are made of the radial distances of spots or rings in the diffraction diagrams of thin sheets of silver, aluminium, or gold of known thickness. An accuracy approaching 1% is possible.

621.317.32.087 **792**

Simultaneous Recording of Current, Voltage and Short-Period Voltage Fluctuations.—E. Schwabe. (*Arch. tech. Messen*, May 1940, No. 107, p. T49.) A triple recorder using current and voltage transformers and, for recording the voltage fluctuations, a lamp and photocell with compensation for normal voltage.

621.317.334 **793**

Adaptation of the Method of Maxwell-Wien to the Precise Comparison of Inductance Standards.—R. Hérou & M. Romanowski. (*C. R. Acad. Sci., Paris*, 1st April 1946, Vol. 222, No. 14, pp. 789–791.) If P and Q are the resistances of two opposite arms of a Maxwell-Wien bridge, a fixed capacitor being connected in parallel with the third arm and inductances L_1, L_2 inserted successively in the fourth arm, the bridge arms all being approximately equal and earth capacitances and residual inductances compensated, then $L_1/L_2 = P_1 Q_1/P_2 Q_2$. P and Q should be of the type used for high precision measurements, variable in 1-Ω steps. Final balance is achieved by means of a resistor of 100 Ω, shunted by a variable capacitor, in series with the inductance. Tests carried out with frequencies of 1 000 and 100 c/s show that with such an arrangement inductance comparisons can be effected with an accuracy of about 1 in 10^5 and this may be increased when the apparatus details are perfected.

621.317.35 : 578.088.7 **794**

A New Electronic [infrasonic frequency] **Analyser.**—G. R. Baldock & W. Grey Walter. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, pp. 339–344.) The apparatus consists of a number of selective circuits which respond to frequencies between 1.5 and 30 c/s. These circuits are RC phase-shift positive feedback amplifiers with gains adjusted to values below that at which oscillation occurs. An epoch of an aperiodic waveform may be analysed be means of a switch which selects each of the selective circuits. An additional circuit, called an averager, records the analysis of the record over periods of one to two minutes. The analyser records the mean relative amplitudes throughout the period, but it will not distinguish between a large signal present for a short time and a smaller one present for a long time. Its main use is for vibration studies and bioelectric effects.

621.317.372 : 621.315.2 **795**

End Leakage in Cable Power-Factor Measurement.—A. Rosen. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, p. 549.) Summary of 176 of January.

621.317.42 **796**

A B-H Curve Tracer for Magnetic-Recording Wire.—T. H. Long & G. D. McMullen. (*Trans. Amer. Inst. elect. Engrs*, June Supplement 1946, Vol. 65, pp. 494–495.) Discussion of 2247 of 1946.

621.317.44 : 621.318.32 **797**

New Method for the Study of Ferromagnetic Materials in Weak A.C. Fields. Application to Some Alloys.—I. Épelboïm. (*Rev. gén. Élect.*, July & Aug. 1946, Vol. 55, Nos. 7 & 8, pp. 271–281 & 310–324.) Theory and operational details are given of a bridge method. A specially designed demountable coil attachment permits accurate and reproducible results. The nickel alloys anhyster-D, mumetal and permalloy were studied after each had been subjected to two different heat treatments resulting in widely differing magnetic characteristics. In the case of the 76%-nickel alloys, the existence of a superstructure in annealed permalloy and of anistropy of the copper in tempered mumetal may account for the observed differences. Measurements were made at frequencies from 50 to 10 000 c/s. The effective resistance to eddy currents was found to be less than the d.c. resistance and the ratio of permeability to effective resistance was constant over a wide frequency range. Rayleigh's law is shown to be valid whatever the difference between the crystalline energy and that of the internal strains in a ferromagnetic material. The empirical law proposed by Sixtus is found inaccurate. The anomalous behaviour of the permeability characteristic as a function of the field can be explained by the effect of harmonics.

621.317.7 + 681.2].085.34 **798**

A Scanning Device for All Types of Luminous-Spot Measuring Apparatus.—F. Perrier. (*C. R. Acad. Sci., Paris*, 8th April 1946, Vol. 222, No. 15, pp. 868–869.) The beam reflected from a rotating mirror is given a motion at right angles to its usual path by interposing a suitable screen between the mirror and the source, the deflexion law being determined by the shape of the screen. Where one variable is the time, the screen may be semi-cylindrical, pierced with a helical slot and suspended from a torsion pendulum. This produces a sinusoidal sweep. Alternatively, a motor-driven disk has its edge cut to the shape of identical portions of Archimedean spirals. This gives a saw-tooth linear sweep.

621.317.7.029.64 **799**

Microwave Test and Measuring Equipment.—W. T. Jones. (*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 48–54 . . 136.) A review of the various types of instruments and methods developed for the measurement at u.h.f. of (*a*) frequency, using cavity and coaxial line type meters, (*b*) spectrum distribution, (*c*) power, using diodes, crystals, thermocouples, calorimeters or bolometers, (*d*) attenuation, and (*e*) standing-wave ratios, by insertion of a slotted section of transmission line between generator and load, with a pickup probe moved along the line and a meter to indicate the relative field strength at points under examination.

621.317.7.029.64 **800**

Microwave Measurements and Test Equipments.—F. J. Gaffney. (*Proc. Inst. Radio Engrs, W. & E.*, Oct, 1946, Vol. 34, No. 10, pp. 775–793.) A general summary is given of the methods of measuring such quantities as standing-wave ratios, impedance, power, attenuation and frequency. The electrical and mechanical considerations in the design of microwave measurement apparatus and the accuracies at present obtainable are discussed. The application of the methods to the measurement of the performance of radar systems is outlined.

621.317.71/.72].082.742 **801**

Moving-Coil Current and Voltage Multi-Range Meters.—J. Bubert. (*Arch. tech. Messen*, June 1940, No. 108, p. T68.) Design considerations.

621.317.714 + 621.317.725 **802**

Frequency Compensated A.C. Ammeters and Voltmeters.—J. M. Whittenton & C. A. Wilkinson. (*Trans. Amer. Inst. elect. Engrs*, Nov. 1946, Vol. 65, No. 11, pp. 761–764.) Impedance changes can cause frequency errors in moving-iron voltmeters, while eddy currents can cause them in both ammeters and voltmeters. By suitable choice of materials, eddy currents can be made negligible. Errors due to impedance changes can be corrected by shunting about 75% of the series resistance with a capacitor.

621.317[.72 + .784 **803**

A Precision A.C./D.C. Comparator for Power and Voltage Measurements.—G. F. Shotter & H. D. Hawkes. (*J. Instn. elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 549–550.) Summary of 183 of January.

621.317.73 **804**

Reactance Comparator.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 142 . . 150.) The tuning of a circuit containing the test reactor is varied by a vibrating reed capacitor. A thyratron-controlled stroboscope lamp illuminates a pointer attached to the reed when the natural frequency of the test reactor equals that of the oscillator under test.

621.317.73 : 518.3 **805**

Capacity Nomogram for Use with Avometer Type D.—R. Terlecki & J. W. Whitehead. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, p. 336.) The unknown capacitance is connected in series with the 230-V a.c. mains and the Avometer, set to the 300 V a.c. range. The nomogram shown can then be used for measuring capacitances from 200 to 100 000 pF.

621.317.733 **806**

An Equal-Ratio Impedance Bridge.—L. G. Alexander. (*A. W. A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 59–77.) A detailed description of a bridge which has an accuracy of 1%, or better, in measuring impedances at frequencies up to 3 Mc/s.

621.317.733 : 518.4 **807**

Universal Chart for Unbalanced Bridge.—R. C. Paine. (*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 72–74..110.) Gives graphical methods for determining the detector voltages of unbalanced bridges and derives a universal chart.

621.317.75 : 621.396.619 : 621.397.61 **808**

Test Oscilloscope for Television Stations.—A. H. Brolly & W. R. Brock. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 120–122.) For measurement of transmitter modulation. The r.f. signal is picked up from the transmitter feeder and is fed through a tuned transformer directly to the Y-deflexion plates of a cathode-ray tube; a timebase for the X deflexion operates at half the time frequency.

621.317.755 : 621.3.001.4 **809**

Routine Testing by Cathode Ray Oscillograph.—F. Haas. (*Toute la Radio*, June 1946, Vol. 13, No. 106, pp. 161–163.) Full circuit details are given for apparatus which gives a vertical trace on a c.r.o. corresponding to a particular frequency. For routine testing of capacitors or inductances connexions are made to an oscillator so that the trace on the c.r.o. is displaced from the central position by an amount proportional to the percentage error. The method is readily adaptable to routine testing of lengths, thicknesses, angles, etc.

621.317.757 **810**

A Non-Reactive [Déphaseuse] **Valve and a New Method of Harmonic Analysis.**—A. Colombani. (*C. R. Acad. Sci., Paris*, 8th Oct. 1945, Vol. 221, No. 15, pp. 399–401.) Across the anode resistance of a pentode is connected, through 1-μF capacitors, a bridge of two fixed resistors, one variable resistor R and a variable capacitor C. The voltage across one diagonal of the bridge can be varied both in magnitude and phase with respect to that across the other diagonal by suitably altering R and C. By coupling this circuit to a variable frequency oscillator, together with the source to be analysed, it is possible to measure the frequencies, amplitudes, and phase differences of the harmonics with reference to the fundamental.

621.317.76.029.64 **811**

U.H.F. Signal Generator [Mark SX-12].—(*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 76–77.) A set of five interchangeable klystrons supplies microwave energy at any frequency from 2 600 Mc/s to 10 300 Mc/s and can be matched to any load by means of a tunable double-stub transformer. It delivers at least 200 mW, and up to 750 mW in certain frequency ranges. The stable output can be modulated either in frequency or in amplitude. A built-in generator gives undistorted square-waves up to 100 V (peak) in the range 350–3 500 c/s, and may be externally synchronized. The electronically regulated power supply of the klystron delivers up to 1 250 V with better than ± 0.2 V regulation, and less than 0.2 V peak to peak ripple.

621.317.761 **812**

Precision Frequency Meter.—P. Bernard. (*Toute la Radio*, May 1946, Vol. 13, No. 105, pp. 121–124.) An account of a rack-mounted equipment of controlled multivibrators, selectors, mixers and filters designed originally for the precision measurement of quartz crystal frequencies by unskilled workmen. The unknown frequency is caused to beat successively with standard decade frequencies and can be read directly from the settings of the various selectors. An absolute precision to within 1 c/s is obtainable.

621.317.784 : 621.392 **813**

A Wide-Band Wattmeter for Wave Guide.—H. C. Early. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1946, Vol. 34, No. 10, pp. 803–807.) Used to measure the power transmitted by a waveguide or coaxial transmission line, the wattmeter consists of a special section of $1\frac{1}{2}$ inches by 3 inches waveguide containing a tapered ridge, with a directional coupler assembly connected to two lengths of cable, each with a thermojunction at the end and a low resistance microammeter. The cable lengths are so chosen that the variation of attenuation with frequency compensates for the variation of voltage pick-up in the coupler loop, giving a substantially constant calibration over the range 8–12 cm.

621.317.784.029.64 **814**

Microwave Wattmeter.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 164..169.) The current flowing into a matched terminated transmission line is measured by a thermocouple. At low frequencies (20 Mc/s) the terminating resistance decides the input impedance while at high frequencies (1 500 Mc/s) the line has sufficient loss for the characteristic impedance to be the deciding factor.

621.362 **815**

Characteristics of Thermocouples.—C. T. Weller. (*Gen. elect. Rev.*, Nov. 1946, Vol. 49, No. 11, pp. 50–53.) Standard calibration points, operating ranges, and limits of departure from the average curve are tabulated for the five principal types of thermocouple, namely copper-copnic, iron-copnic, chromel-copnic, chromel-alumel, and platinum-platinum with 10% rhodium. The voltage is also shown graphically as a function of temperature difference between the two ends for these types of thermocouple, and is tabulated for copper-copnic thermocouples.

621.385 : 621.317.7 **816**

Simple Valve Tester.—R. E. Hartkopf. (*Wireless World*, Dec. 1946, Vol. 52, No. 12, pp. 386–390.) For measurement of insulation, mutual conductance and emission.

621.396.611 : 621.396.615.18 **817**

The Inductance-Capacitance Oscillator as a Frequency Divider.—E. Norrman. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1946, Vol. 34, No. 10, pp. 799–803.) The basic circuit and the effects of changes in the values of the circuit components on the range of frequency control are discussed. Details are given of a four-stage frequency divider, with an output of 90 c/s, controlled by an 81 kc/s quartz crystal oscillator. The method of tuning the successive oscillator stages is described.

621.396.615.14.029.54/.62 **818**

Design of F. M. Signal Generator.—D. M. Hill & M. G. Crosby. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 96–101.) The means of obtaining constant frequency deviation with a reactance modulator are discussed for both heterodyne and the constant-deviation variable oscillator systems. In the latter, which is shown to be the more efficient, a modulation input potentiometer is ganged with the tuning dial. A satisfactory design is one in which the reactance-modulated oscillator operates from 27 to 54 Mc/s, and is balanced by a doubler stage and a second doubler output stage, providing frequency coverage from 54 to 216 Mc/s. Maximum stability and simplicity are achieved since oscillator and modulator operate at a low frequency and r.f. switching is simple. By means of a converter, the range 100 kc/s – 25 Mc/s can also be covered.

621.396.62.029.64 **819**

Components of U.H.F. Field [strength] **Meters.**—E. Karplus. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 124–129.) A description of the characteristics of the various units concerned. (*a*) The tuning limitations of butterfly circuits, which are described in detail in 3260 of 1945 (Karplus), are discussed in terms of circuit dimensions. Where low losses are more important than wide tuning range, cylinder or coaxial butterfly circuits are preferable. These are fully described in 1797 of 1946 (Gross). (*b*) A tunable resonator with a five-to-one frequency range is described, which uses a short, fixed waveguide and a long flexible conductor which is pushed through the guide as required to produce resonance. (*c*) For a cartridge type crystal detector the correction for frequency is examined, and necessary precautions in use are mentioned. (*d*) The output from a signal generator may be checked by measuring either the input to the attenuator or the output at a known attenuator setting. (*e*) A regulated power supply can be obtained by using a controlled saturable reactor in the power input circuit.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

539.16.08 : 546.841.78 : 621.385.032.21 **820**

A Geiger Counter for Determination of Thorium Content of Thoriated-Tungsten Wire.—R. E. Aitchison. (*A. W. A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 1–5.)

621.314.12 : 621.3.07 **821**

Industrial Applications of the Amplidyne.—F. Penin. (*Rev. gén. Élect.*, July 1946, Vol. 55, No. 7, pp. 266–270.) Essentially consisting of two generators in series, the amplidyne gives power amplification of the order of 10 000, with a low time constant, so that a power of a few microwatts from a radar receiving aerial can be applied through an electronic amplifier to operate apparatus requiring hundreds of kilowatts. Industrial applications are described, such as the control of h.f. alternators for induction furnaces, or of the voltage of a d.c. generator, with limitation of the current.

621.315.332.7.001.4 **822**

Process Testing of Film Continuity on Formex Fine Wire.—B. Mulvey. (*Gen. elect. Rev.*, Nov. 1946, Vol. 49, No. 11, pp. 46–48.) An apparatus consisting essentially of mercury electrodes, an electronic relay, and a recorder is used to count the number of breaks in enamel film covering fine wire as soon as the wire is made. Constructional and operating details are given.

621.317.35 : 578.088.7 **823**

A New Electronic [infrasonic frequency] **Analyser.**—Baldock & Grey Walter. (*See* 794.)

621.317.39 : 531.7 **824**

Recent Electrical Devices for the Measurement of Forces, Acceleration and Displacements.—H. Gondet. (*Rev. gén. Élect.*, April 1946, Vol. 55, No. 4, pp. 123–135.) Many practical inventions are described, based on the properties of piezoelectric crystals, magnetostriction, variation of magnetic fields, capacitance, resistance and inductance changes. Devices using a photoelectric cell are also discussed. An indication is given of the accuracy to be expected.

621.317.39 : 633.1 **825**

Determination of the Moisture Content of Cereals by Measurement of Specific Inductive Capacity.—L. G. Groves & J. King. (*J. Soc. chem. Ind., Lond.*, Oct. 1946, Vol. 65, No. 10, pp. 320–324.)

621.317.725 : 621.385 : 536.52 **826**

Flame Radiation Measuring Instrument.—E. M. Yard. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 102–104.) A highly stable bridge-type battery-operated valve voltmeter connected to a radiation pyrometer, for checking performance of open-hearth steel furnaces.

621.318.572 : 531.76 **827**

High Speed Counter.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 190, 192.) The apparatus, now being produced in quantity, can be used to measure velocities and accelerations for intervals up to 1 sec in steps of 1 μs.

621.365 **828**

High-Frequency Heating.—M. J. A. (*Toute la Radio*, July/Aug. 1946, Vol. 13, No. 107, pp. 168–173.) Practical methods and applications.

621.365.5 **829**

Duplex Operation of Induction Heaters.—W. C. Rudd. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 93–95.) Multiple connexion of identical units, for either two-phase or three-phase input, can provide twice the power of either unit operating alone.

621.383 : 535.24 **830**

Logarithmic Photometer.—M. H. Sweet. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 105–109.) A method for obtaining logarithmic response to light intensity from a photocell.

621.383 : 535.33.071 **831**

Observation of Spectral Lines with Electron Multiplier Tubes.—J. D. Craggs & W. Hopwood. (*Nature, Lond.*, 2nd Nov. 1946, Vol. 158, No. 4018, p. 618.)

621.384 **832**

A New Method for Displacing the Electron Beam in a Synchrotron.—J. S. Clark, I. A. Getting & J. E. Thomas, Jr. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 562–563.) Auxiliary coils are provided to induce radial oscillations of the beam, which can be swept across the target in a time of the order of 2 μs.

621.384.6 **833**

The Betatron.—A. Ghosh. (*Sci. Culture*, Aug. 1946, Vol. 12, No. 2, pp. 75–85.)

621.384.6 **834**

Experimental 8 MeV Synchrotron for Electron Acceleration.—F. K. Goward & D. E. Barnes. (*Nature, Lond.*, 21st Sept. 1946, Vol. 158, No. 4012, p. 413.) Results obtained indicate that the synchrotron gives much greater energy and X-ray yield than the betatron without increase in magnet size.

621.385.833 **835**

Determination of the First Order Elements of Symmetrical Electrostatic Lenses.—P. Chanson, A. Ertaud & C. Magnan. (*C. R. Acad. Sci., Paris*, 20th Aug. 1945, Vol. 221, No. 8, pp. 233–235.)

621.386 + 537.531] : 535.34 **836**

Absorption Measurements for Broad Beams of 1- and 2-Million-Volt X-Rays.—G. Singer, C. B. Braestrup & H. O. Wyckoff. (*Bur. Stand. J. Res.*, Aug. 1946, Vol. 37, No. 2, pp. 147–150.)

621.396 : 539.172.4 **837**

Electronics at Bikini.—D. G. Fink & C. L. Engleman. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 84–89.) A description, with photographs, of the equipment used at the atomic bomb tests for recording the geophysical phenomena and for examining the effects of blast and radiation on radio equipment.

621.396.029.64 : 643.33 **838**

Radarange for Cooking.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 178, 180.) Microwave cooking using a magnetron and a horn aerial to direct r.f. energy into food. See also *Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, p. 591.

621.398 **839**

Continuously Variable Radio Remote Control.—Moore. (*See* 682.)

621.398 : 621.6.031 **840**

Carrier Supervisory Control of Pumping Station over Power Cable.—W. A. Derr, W. A. Keller & H. A. W. Hedke. (*Trans. Amer. Inst. elect. Engrs*, Nov. 1946, Vol. 65, No. 11, pp. 699–710.)

629.123 : 621.3.013.8 **841**

The Magnetic Field of a Ship and Its Neutralization by Coil Degaussing.—W. C. Potts. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 488–495. Discussion, pp. 522–524.)

629.123 : 621.3.013.8 **842**

The Electrical Engineering Aspect of Degaussing.—I. S. Fraser, A. A. Read & B. E. Vieyra. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 496–507. Discussion, pp. 522–524.)

629.123 : 621.3.013.8 **843**

Processes applied to a Ship to alter Its State of Magnetization.—S. H. Ayliffe. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 508–517. Discussion, pp. 522–524.)

629.123 : 621.3.013.8 **844**

The Correction of Ships' Magnetic Compasses for the Effects of Degaussing.—H. C. Wassell & D. A. Turner. (*J. Instn elect. Engrs*, Part I, Nov. 1946, Vol. 93, No. 71, pp. 518–522. Discussion, pp. 522–524.)

PROPAGATION OF WAVES

534.1 + 535.13] Huyghens **845**

On Huyghens' Principle.—Y. Rocard. (*Onde élect.*, July 1946, Vol. 26, No. 232, pp. 288–298.) A presentation intended to be mathematically rigid and physically useful. The derivation of Kirchhoff's formula from Green's theorem is given and the formula is applied to the simple case of acoustical radiation from a monochromatic point source. The application to electromagnetic waves is considered, and the radiation from an elementary area dS situated in a normal plane wave is discussed in detail and the diffracted energy calculated. The case of larger obstacles is considered ; in particular Darbord's method is applied to a doublet at the focus of a parabolic mirror.

538.566 : 551.4 **846**

The Diffraction of Radio Waves around the Surface of the Earth.—V. A. Fock. Published as a monograph by the Academy of Sciences of the U.S.S.R., Moscow, 1946, 80 pp. In Russian.

A theoretical treatment of the propagation of radio waves round the curved surface of the earth for distances short enough for ionospheric influences to be negligible. The finite conductivity of the earth is taken into account. Formulae appropriate to the region where the transmitter and the observation point are intervisible, and also to the diffraction zone, are derived, and particular attention is paid to the evaluation of the field in the region of the 'cut-off' point.

The work is in agreement with the earlier considerations of Weyl and van der Pol, but represents an extension of their analyses, particularly in so far as it permits the determination of the field produced by ultra-short waves just inside the diffraction zone.

538.566.2 + 534.222.1 **847**

Propagation of Radiation in a Medium with Random Inhomogeneities.—P. G. Bergmann. (*Phys. Rev.*, 1st/15th Oct. 1946, Vol. 70, Nos. 7/8, pp. 486–492.) An analysis is given of the propagation of radiation through a medium whose index of refraction varies from point to point or from time to time in a random manner. The methods of geometrical optics are used to correlate statistically the variations in optical path length and received signal level with the properties of the inhomogeneities. The dependence of signal fluctuation on range may be predicted without a detailed knowledge of the statistical properties of the medium. The results obtained may be applied to the propagation of either electromagnetic or sound waves of high frequency in the atmosphere.

551.510.535 **848**

High-Power Radio Soundings of the Ionosphere.—Lejay & Chezlemas. (*See* 726.)

621.396.11 **849**

Propagation of Electromagnetic Waves in a Medium with Non-Uniform Electrical Characteristics and with a Magnetic Field. [Thesis]—C. T. F. van der Wyck. Drukkerij Waltman (A. J. Mulder), Delft, 1946. In Dutch, with long English summary.

Theoretical analysis of the propagation of plane, cylindrical, and spherical waves, in a medium with an exponential variation of electrical characteristics in a vertical direction, under the influence of a uniform magnetic field.

621.396.81.029.64 : 629.13 **850**

Effect of Aircraft on Fading.—J. W. Whitehead. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, p. 29.) The type of fading to be expected in v.h.f. ground-based communication systems due to reflection from an aircraft is briefly discussed and illustrations are given.

621.396.812.029.4/.5 : 539.172.4 **851**

A Note on "The Possible Effect of the Atomic Bomb Test at Bikini on Radio Reception", at about 3.05 a.m. (I.S.T.) on 25th July 1946.—S. P. Chakravarti. (*Curr. Sci.*, Aug. 1946, Vol. 15, No. 8, pp. 226–227.) The results of some observations taken at Bangalore in the direction of Bikini during the test. Reception of atmospherics at λ 20 000 m was increased; the field strength of an American station on λ 25.3 m decreased considerably.

621.396.812.029.64 **852**

Propagation of Microwaves.—A. de Gouvenain. (*Toute la Radio*, Feb. 1946, Vol. 13, No. 103, pp. 50–52.) A survey of general propagation characteristics, taking account of refraction, with application to u.s.w. link calculations.

621.396.812.3 : 551.510.535 **853**

Space-Diversity Reception and Fading of Short-Wave Signals.—S. S. Banerjee & G. C. Mukerjee. (*Nature, Lond.*, 21st Sept. 1946, Vol. 158, No. 4012, pp. 413–414.) An account of observations on the fading of signals of 16–41 m wavelength over a 700 km path. Occasionally the nature of the fading changes from random fluctuations to smooth and quasi-periodic variations, according as the signals suffer single or multiple reflection in the ionosphere.

621.396.96 : 523.53 "1946.10.09" **854**

Radar Observations during Meteor Showers 9 October 1946.—R. Bateman, A. G. McNish & V. C. Pineo. (*Science*, 8th Nov. 1946, Vol. 104, No. 2706, pp. 434–435.) A peak pulse power of about 100 kW on 107 Mc/s was used in tests carried out at the Sterling (Virginia) Laboratory of the National Bureau of Standards. Observations were both visual and photographic. On 9th Oct. 1946 the rate of occurrence of radar echoes rose from about 8 per hour at 7.30 p.m., 75°W mean time, to a peak of over 60 per hour between 10.30 and 11.30 p.m., the predicted time for the maximum intensity of the Draconid shower being 10.00 p.m. Cloud prevented visual observations.

RECEPTION

621.396.62 **855**

High Fidelity Receiver.—J. C. Hoadley. (*Radio News*, Nov. 1946, Vol. 36, No. 5, pp. 46–48.) Straight r.f. amplification; infinite impedance detector.

621.396.62 : 621.317.79 **856**

A Signal Tracer.—F. Haas. (*Toute la Radio*, Feb. 1946, Vol. 13, No. 103, pp. 56–58.) A practical instrument for fault finding in receivers, which enables the signal to be followed from the aerial socket to the loudspeaker.

621.396.62 : 621.396.619.13].015.33 **857**

The Theory of Impulse Noise in Ideal Frequency-Modulation Receivers.—D. B. Smith & W. E. Bradley. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1946, Vol. 34, No. 10, pp. 743–751.) An analysis is given of the effect of impulsive noise on an ideal f.m. receiver. It is shown that the amplitude and waveform of the generated noise are substantially independent of the amplitude and waveform of the initiating noise. One form of generated noise is determined largely by the characteristics of the audio amplifier and results from a perturbation of the phase of the detector signal, while another and more objectionable form is produced by the de-emphasis circuit when the phase of the detector signal is caused to slip one revolution.

"An operational formula for the ideal detection process is given from which both the steady-state and transient solutions of the detection process may be derived."

621.396.62.029.52/.62 **858**

Special-Purpose Receivers for the Range 50 kc/s to 50 Mc/s.—B. Sandel. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 89–93.) A brief description of two directly-calibrated receivers, covering respectively the ranges 50 kc/s–5 Mc/s in six bands, and 5–50 Mc/s in eight bands. They were used for testing signal generators.

621.396.621 **859**

Murphy A104.—(*Wireless World*, Dec. 1946, Vol. 52, No. 12, pp. 394–395.) Test report on table model receiver for a.c. mains.

621.396.621 **860**

New Communication Receiver.—(*Wireless World*, Dec. 1946, Vol. 52, No. 12, p. 425.) A brief description of equipment B40/B41 made by Murphy Radio for the Admiralty, consisting of two receivers covering the ranges 640 kc/s–30.6 Mc/s and 14.7–720 kc/s.

621.396.621.029.5 **861**

Some Considerations in the Design of Communication Receivers.—I. F. Simpson. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, pp. 332–336.) Desirable qualities of self-contained and semi-portable receivers in the frequency range 130 kc/s–30 Mc/s are considered, and the compromises which have been necessary in their development. An accurately calibrated oscillator, stable to within ±6 kc/s at 30 Mc/s, is the most important requirement. Sensitivity, a.v.c., noise, selectivity, ease of handling, flexibility, spurious response, and signal strength indication are also discussed.

621.396.621.029.54 **862**

A Home-Made Midget Receiver.—L. G. Woollett. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, p. 352.) Employs an internal frame aerial, uses ordinary battery-type valves, and is internally powered. Frequency range is 588–1 230 kc/s, and dimensions are $4\frac{5}{8}$ inches × $4\frac{1}{8}$ inches × $3\frac{3}{4}$ inches.

621.397.82 **863**

Television Sound Rejection.—Cocking. (*See* 922.)

621.396.822 **864**

Noise Factor: Part 1.—L. A. Moxon. (*Wireless World*, Dec. 1946, Vol. 52, No. 12, pp. 391–393.) A discussion and definition of noise factor. It is defined as the number of times by which the available signal power must exceed *KTB*, where *K* is Boltzmann's constant, *T* the absolute temperature and *B* the ' energy bandwidth ', in order to give unity ratio of available signal-to-noise power at the input to the detector.

621.396.822 : 621.396.671 **865**

Study of the Thermal Equilibrium of Wireless Aerials.—Lehmann. (*See* 642.)

621.396.828 **866**

Noise Limiters.—H. B. Dent. (*Wireless World*, Dec. 1946, Vol. 52, No. 12, pp. 397–398.) The Dickert shunt-type noise limiter and improvements of it are described. The noise is automatically limited to the strength of the carrier instead of to a predetermined level. Circuit diagrams are given.

621.396.828 + 621.396.665 **867**

Noise and Output Limiters : Part 1.—E. Toth. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 114–119.) A comprehensive survey, with circuit diagrams, of eleven limiting circuits for a.m. communication receivers, including simple diode circuits, balanced detectors, self-adjusting circuits, and degenerative arrangements. Analysis of operation, and advantages and disadvantages are stated for each type of circuit.

STATIONS AND COMMUNICATION SYSTEMS

621.315.66 **868**

New " Microwave Tower ".—(*J. appl. Phys.*, Sept. 1946, Vol. 17, No. 9, p. 757.)

621.395 : 654.05 **869**

Intensity Fluctuations in Telephone Traffic.—C. Palm. (*Ericsson Technics*, 1943, No. 44, pp. 3–189. In German.) Three principal sections : (1) Telephone traffic considered as a stochastic (*i.e.*, pertaining to conjecture) process. (2) Intensity fluctuations as a starting point for the treatment of telephone traffic problems. (3) Measurement methods and results.

621.396(675)" 1939/1945 " **870**

Telecommunications in the Belgian Congo during the War.—A. Huynen. (*Bull. sci. Ass. Inst. électrotechn. Montefiore*, April/May 1946, Vol. 59, Nos. 4/5, pp. 247-262.) From Oct. 1940 short wave transmissions from the Congo station at Leopoldville were well received in Belgium, as the Germans were unable to jam them to any extent. For retransmission of the B.B.C. news bulletins in French, a receiver was tuned to each of the B.B.C. frequencies, thus giving a choice at any time for retransmission under the best possible conditions. When the Germans jammed the B.B.C. frequency in use, simple switching arrangements gave an instantaneous change to one not being jammed.

621.396.1 **871**

Moscow [telecommunications conference]. —A.L.B. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 25–27.) Account of the discussions on amateur frequency allocations.

621.396.1.029.62/.63 **872**

A Plan for [improved frequency allocation in] **the Ten-Meter Band.**—K.B.W. (*QST*, Dec. 1946, Vol. 30, No. 12 , pp. 26–27..130.)

621.396.324 **873**

High-Flying Teletype.—R. A. Vanderlippe. (*Bell Lab. Rec.*, Nov. 1946, Vol. 24, No. 11, pp. 396–399.) A lightweight teletype printer with an associated converter-control unit which makes it practicable to send teletype messages to and from aircraft in flight.

621.396.619[.13 + .16 **874**

Frequency Modulation : Pulse Modulation.—C. Dreyfus-Pascal. (*Toute la Radio*, May 1946, Vol. 13, No. 105, pp. 126–128.) A short account of an f.m. system of the Federal Telephone and Radio Corporation which enables 24 programmes to be transmitted on the same carrier wave, together with a synchronization signal. The system uses an electronic commutator with 24 elementary pentodes, each of which is linked with a particular studio. The electronic beam rotates at 24 000 c/s and the carrier frequency used is 1 300 Mc/s. See also 239 of January.

621.396.619.16 **875**

Pulse Time Modulation Circuits.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 140, 142.) A preliminary description of this Federal Telecommunication Laboratories equipment was given in 2803 of 1945 (Deloraine & Labin). The transmitter will take eight audio channels with fidelity over the a.f. range 50–9 000 c/s. Its output is approximately 800–1 000 W (peak) and 40–50 W (average). This is fed to a vertically stacked omni-directional loop aerial having a gain of 9 db over a dipole. The directive receiving aerial has a parabolic reflector, with a gain of 17 db.

621.396.65 **876**

Radio Relays for Telegraphy.—F. B. Bramhall. (*Elect. Engng, N.Y.*, Nov. 1946, Vol. 65, No. 11, pp. 516–520.) Relay towers 20 to 50 miles apart will be used in a Western Union triangular radio network, New York–Washington–Pittsburgh, operating at 4 000 Mc/s with an ' audio ' width of 150 kc/s divided into 1 080 teleprinter operating circuits. The absence of noise in this band and the heavy traffic makes the project economical.

621.396.7.029.58 **877**

World List of Short-Wave Transmitters.—(*Toute la Radio*, May 1946, Vol. 13, No. 105, pp. 118–119.) A list of the frequencies, call signs and locations of transmitters with frequencies from 2.5–26.55 Mc/s.

621.396.712 **878**

Cooperative Two-Station Antenna System.—L. McManus. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 154..164.) A system of phasing units and filters permits the simultaneous use of two towers as radiators and driven reflectors for two broadcasting transmitters at Sherbrooke, Quebec.

621.396.712 : 621.316.9 **879**

Protecting against Carrier Failure.—H. G. Towlson. (*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, pp. 68–71..116.) " Practical methods of insuring against interruptions and loss of broadcasting time due to lightning and other causes."

621.396.712.3 **880**

New Station Techniques.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 169..176.) A summary of recent developments in B.B.C. studio organization, and of the results of extensive f.m. field trials, abstracted from the new journal *B.B.C. Quart.*

621.396.72 **881**

Army Broadcasting.—P.B.J. (*Wireless World*, Dec. 1946, Vol. 52, No. 12, p. 414.) Location and frequencies of stations used for broadcasting to the British and American Forces.

621.396.81.029.64 : 629.13 **882**

Effect of Aircraft on Fading.—Whitehead. (*See* 850.)

621.396.931 **883**

Two-Way Radio for Power Line Crews.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, p. 123.) Photographs of a f.m. transmitter and a mobile receiver.

621.396.931 **884**

Inductive System for Train Communication.—P. N. Bossart. (*Telegr. Teleph. Age*, Nov. & Dec. 1946, Vol. 64, Nos. 11 & 12, pp. 8–10, 30 & 16–19.) For communication between vehicles of the same or different trains, or between vehicles and wayside stations. At frequencies below 10 kc/s the reliable range is of the order of a mile if only the rails are used, but can be increased up to 30 or 40 miles if adjacent line wires are available. Carrier frequencies up to 100 kc/s, preferably with f.m., are used. Break-in schemes, power requirements, receiver sensitivities, squelch systems and channel widths are discussed. A 'carrytone' portable telephone can be provided to enable individuals, not necessarily in any vehicle, to communicate within the system.

621.396.931 **885**

Railroad Radiotelephone Tests on the Nickel Plate Road.—R. G. Peters. (*Communications*, Nov. 1946, Vol. 26, No. 11, pp. 14–16..34.) See also 884 and 886.

621.396.931.029.62 **886**

Two-Way V.H.F. Radio in Potomac Yard improves Control of R.R. Operations.—(*Telegr. Teleph. Age*, Dec. 1946, Vol. 64, No. 12, pp. 5–6.) Description of tests of a comprehensive v.h.f. two-way radiotelephone installation as a means of improving managerial control in the operation of large railway yards. The f.m. system included a central station transmitter and receiver, five remote control units located at key points, a mobile transmitter and receiver on each of two steam locomotives, and remote control units on their forward platforms and in their cabs. See also 885.

621.396.933 **887**

The Radio Equipment used by the Pilot of an Aircraft and the Corresponding Ground Installations.—S. Gaillard. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 333–342.) A description of airborne and ground apparatus developed by the Société Indépendante de T.S.F. for the communication of landing and take-off instructions between the aerodrome controller and the pilot. The airborne transmitter (frequency band 2 800–6 700 kc/s) works on telegraphy or telephony with 20 W aerial power; the receiver requires 10 μV input for 350 mW output with a signal-to-noise ratio of not less than 26 db. The ground apparatus is similar but is designed for a.c. mains power supply.

An airborne beacon receiver (200–428 kc/s) is also described.

621.396.97.029.62 **888**

Against V.H.F. Broadcasting.—"Radiophare". (*Wireless World*, Dec. 1946, Vol. 52, No. 12, p. 412.) The objection to broadcasting on frequencies as high as 90 Mc/s with a service range of only 50 miles is that broadcasting, if limited to such frequencies, would tend to lose its international character.

SUBSIDIARY APPARATUS

531.35 : 621.396.619.13 : 621–526 **889**

A Low Frequency Mechanical Modulator.—B. B. Underhill. (*Rev. sci. Instrum.*, July 1946, Vol. 17, No. 7, pp. 280–281.) A medium-speed motor drives a fly-wheel through a continuously variable reduction gear. The motion of the fly-wheel is converted to s.h.m. by a scotch yoke-rack and pinion assembly to which a linear potentiometer is directly coupled.

621–526 **890**

Linear Servo Theory.—R. E. Graham. (*Bell Syst. tech. J.*, Oct. 1946, Vol. 25, No. 4, pp. 616–651.) "This paper discusses a typical analogy between electrical and mechanical systems and describes, in frequency response language, the behavior of such common servo components as motors, synchro circuits, potentiometers, and tachometers. The elementary concepts of frequency analysis are reviewed briefly, and the familiar Nyquist stability criterion is applied to a typical motor-drive servo system. The factors to be considered in choosing stability margins are listed—system variability, noise enhancement, and transient response. The basic gain-phase interrelations shown by Bode are summarized, and some of their design implications discussed. In addition to the classical methods, simple approximate methods for calculating dynamic response of servo systems are presented and illustrated."

621–526 **891**

Electrical Analogy Methods applied to Servomechanism Problems.—G. D. McCann, S. W. Herwald & H. S. Kirschbaum. (*Trans. Amer. Inst. elect. Engrs*, June Supplement 1946, Vol. 65, p. 515.) Discussion of 1362 of 1946.

621.314 **892**

Operation of a Vibrator.—C. Dreyfus-Pascal. **Vibrator Applications.**—C. Dreyfus-Pascal. (*Toute la Radio*, March/April 1946, Vol. 13, No. 104, pp. 86–88 & 89–91.) A review of the principles of operation, including electromechanical rectification, and circuit diagrams for various practical applications.

621.314.2.04 **893**

Transformer Theory.—P. Bricout. (*C. R. Acad. Sci., Paris*, 2nd July 1945, Vol. 221, No. 1, pp. 21–22.) Theory is given which enables all necessary calculations to be made for transformer design, given the primary and secondary voltages, maximum power, the output and the hysteresis cycle for the laminations on full load.

621.314.63.001.8 **894**

Some Applications of Dry Rectifiers.—J. Girard. (*Rev. gén. Élect.*, May 1946, Vol. 55, No. 5, pp. 192–198.) An account of the application of dry rectifiers to obtain high voltages with low or very low currents, moderate voltages with moderate currents, and low voltages with high currents. Examples are given of equipment for central telephone exchanges. Selenium rectifiers have recently been designed to give 60 000 A at 6 V and currents as high as 150 000 A are envisaged.

621.314.634 **895**

Selenium Rectifiers.—J. Loebenstein. (*Communications*, Nov. 1946, Vol. 26, No. 11, pp. 26–28.) Details of design, construction and characteristics. Applications in single- and 3-phase circuits are described.

621.316.98 **896**

Selective Attraction of Lightning: Role of Electrical Resistances.—S. Szpor. (*Rev. gén. Élect.*, Jan. 1946, Vol. 55, No. 1, pp. 25–31.) Quantitative study of the part played by the electrical resistance of projecting points in attracting lightning shows that it rarely has any effect.

621.317.755.087.5 **897**

An Automatic Oscillograph with a Memory.—A. M. Zarem. (*Trans. Amer. Inst. elect. Engrs*, June Supplement 1946, Vol. 65, p. 514.) Discussion of 2339 of 1946.

621.318.5 **898**

A High-Voltage Vacuum-Sealed Relay.—K. R. Vale. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 95–101.) The relay was designed to be used with aircraft transmitter aerials at voltages up to 15 kV (peak) and at a keying speed of 25 w.p.m.

621.318.572 : 621.396.96 **899**

Spark Gap Switches for Radar.—F. S. Goucher, J. R. Haynes, W. A. Depp & E. J. Ryder. (*Bell Syst. tech. J.*, Oct. 1946, Vol. 25, No. 4, pp. 563–602.) An account of war-time development work on rotary and fixed switches for use in radar modulators.

The irregular breakdown of rotary spark gaps used with modulator switching voltages of less than 20 kV was overcome by irradiating the gap, prior to breakdown, with corona produced by a sharp point on the cathode.

Investigations into the most suitable gas atmosphere, electrode material and gap design for use in sealed-off fixed gaps are fully described with particular reference to the methods adopted for reducing the effects of sputtering of the electrode metals on the gap spacing and insulation.

Operating characteristics for various types of production gaps are given.

621.325.53 : 535.61–15 **900**

Modulated Arc Lamp.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 150, 154.) A caesium vapour lamp for modulated infra-red ray communication in convoy and troop landing operations.

621.352.4 **901**

Water Activated Cell.—(*Electronic Industr.*, Nov. 1946, Vol. 5, No. 11, p. 75.) A primary battery for emergency services using silver chloride as depolarizer and thin magnesium sheet separated by highly absorbent paper. It is both light and small, has indefinite shelf life in its sealed container and is activated by immersion in either fresh or sea water.

621.396.615.17 **902**

A Linear Sweep Generator.—W. J. Haywood. (*Radio News*, Nov. 1946, Vol. 36, No. 5, pp. 78. . 84.) Saw-tooth generator, 1 to 10^6 c/s.

621.396.622.71 **903**

An Unusual Rectifier Circuit.—E. E. Comstock. (*QST*, Nov. 1946, Vol. 30, No. 11, pp. 56–57.) A combination of the conventional bi-phase centre tap rectifier circuit with an inverted form of the same circuit makes four different output voltages available.

621.396.68 : 621.385.832 **904**

R.F. H.T. Power Supplies for Cathode-Ray Tubes.—R. D. Boadle. (*A.W.A. tech. Rev.*, Sept. 1946, Vol. 7, No. 1, pp. 53–57.) Description of a 2-kV unit for an electrostatic cathode-ray tube, and a 4-kV unit for a magnetically deflected and focused tube. The high voltage circuits are enclosed in oil-filled brass or copper tanks, with solder-seal glass insulators.

669 : 621.38/.39 **905**

Specialised Metallurgical Products in Industry.—(*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, pp. 328–331.) An illustrated description of products now available, including cathode tubing, metal films on glass, silvered mica capacitor packs, and specialized contacts.

621.327.4 **906**

Electric Discharge Lamps. [Book Review]—H. Cotton. Chapman & Hall, London, 36s. (*Engineering, Lond.*, 11th Oct. 1946, Vol. 162, No. 4213, p. 339.)

TELEVISION AND PHOTOTELEGRAPHY

621.385.832.087.5 **907**

A New Film for Photographing the Television Monitor Tube.—C. F. White & M. R. Boyer. (*J. Soc. Mot. Pict. Engrs*, Aug. 1946, Vol. 47, No. 2, pp. 152–164.) " A film which is specially adapted for photographing images on the P-4 monitor tube surface has been prepared. Optical sensitization is adjusted to yield peaks of sensitivity with the blue to yellow spectral region corresponding to the emission of the P-4 screen. Resolving power of the film has been found of controlling importance when used in 16-mm size and this factor has affected the choice of emulsion for this purpose. The film may be employed either as a negative or reversed."

621.385.832.088 **908**

C. R. Tube Quality Test.—P. L. F. Jones. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, p. 353.) Apparatus which injects into a television receiver a complete waveform consisting of dots of approximately element duration separated from the next in the line scan direction by an equal space.

621.396.97 : 535.88 **909**

Pre-Television.—P. Toulon. (*Toute la Radio*, July/Aug. 1946, Vol. 13, No. 107, pp. 194–195.) An apparatus resembling an epidiascope may be used with rolls of paper film giving broadcast programme pictures, the rolls being circulated each week for the following week's programmes. Changing of the pictures may be effected by special signals.

621.397.5 **910**

Fundamentals of Television.—(*Cah. toute la Radio,* July 1946, No. 5, pp. 16–19.) The basic features of television transmitting and receiving apparatus are described ; interlacing is illustrated by an inset paragraph with interlaced text.

621.397.5 **911**

Colour Television.—J. Vergennes. (*Cah. toute la Radio,* July 1946, No. 5, pp. 22–25.) Fundamental problems are discussed and a short account is given of the main features of the C.B.S. system using a set of colour screens rotated mechanically, and of Baird's special 3-colour tube.

621.397.5 : 778.5 **912**

The Relation of Television to Motion Pictures.—A. B. Du Mont. (*J. Soc. Mot. Pict. Engrs,* Sept. 1946, Vol. 47, No. 3, pp. 238–247.) A broad discussion of the applications of film recording in the television field, on the basis of the equivalence " . . . film recordings are to television what the transcribed program is to broadcasting " ; and of ways in which the two industries could collaborate.

621.397.5 : 778.5 **913**

Television Reproduction from Negative Films.—E. Meschter. (*J. Soc. Mot. Pict. Engrs,* Aug. 1946, Vol. 47, No. 2, pp. 165–181.) " The expected reproduction characteristics are examined for the cases where film is included as one step of the television process. Features of performance to be expected from both negatives and prints as image sources are predicted from average characteristics of elements of the television system. A dynamic test procedure for the investigation of the over-all reproduction curve involving film and television is described. Actual tests confirm the theoretical prediction that a negative film with a rising shoulder characteristic may provide superior television images."

621.397.6 **914**

Projection Television.—(*Electronics,* Nov. 1946, Vol. 19, No. 11, pp. 212 . . 216.) A description of (*a*) a German lens system for projecting and enlarging phosphorescent images (U.S. Patent 2 229 302) and (*b*) a system with transmission screens of zinc blende as optical polarizing gates controlled by a scanning electron beam (U.S. Patents 2 277 008 and 2 297 443).

621.397.6 **915**

High-Definition Television Equipment.—R. R. Cahen. (*Cah. toute la Radio,* July 1946, No. 5, pp. 14–15.) The special features and general lay-out of an 829-line television equipment with an amplifier pass-band of 15 Mc/s ; the equipment includes telecinema apparatus with an iconoscope.

621.397.61 : 621.317.75 : 621.396.619 **916**

Test Oscilloscope for Television Stations.—Brolly & Brock. (*See* 808.)

621.397.611 : 621.383 **917**

Theory of the Iconoscope.—R. Barthélemy. (*C.R. Acad. Sci., Paris,* 27th Aug. 1945, Vol. 221, No. 9, pp. 245–247.) Summarizes the results of a year's work with the object of reconciling theory and practice. It appears that the simultaneous existence of a state of equilibrium and an appreciable p.d. between the front and back of the moving beam can only be caused by the action of space charge.

621.397.611.2 + 771.53 + 535.736.1 **918**

A Unified Approach to the Performance of Photographic Film, Television Pickup Tubes, and the Human Eye.—A. Rose. (*J. Soc. Mot. Pict. Engrs,* Oct. 1946, Vol. 47, No. 4, pp. 273–294.) " The picture pickup devices—film, television pickup tube, and eye—are subject ultimately to the same limitations in performance imposed by the discrete nature of light flux. The literature built up around each of these devices does not reflect a similar unity of terminology. The present paper is exploratory and attempts a unified treatment of the three devices in terms of an ideal device." In this ideal device scene brightness is proportional to the square of the signal/noise ratio and inversely proportional to the picture element area and to quantum efficiency.

621.397.62 **919**

Pye Television Model B16T.—(*Wireless World,* Dec. 1946, Vol. 52, No. 12, pp. 403–407.) Test report and full circuit diagram.

621.397.62 : 621.392 **920**

The Choice of Transmission Lines for connecting Television Receiving Aerials to Receivers.—Strafford. (*See* 633.)

621.397.645 **921**

Video Amplifier H.F. Response : Part 3.—(*See* 681.)

621.397.82 **922**

Television Sound Rejection.—W. T. Cocking. (*Wireless World,* Dec. 1946, Vol. 52, No. 12, pp. 417–421.) The various forms of rejector and acceptor circuits used in avoiding interference between the sound and vision channels are fully analysed and their effect on the main inter-valve coupling is discussed.

621.397.82 **923**

Television Fading.—G. T. Clack. (*Electronic Engng,* Nov. 1946, Vol. 18, No. 225, p. 353.) Suggestions to reduce the effects of fading in television receivers due to reflections from aircraft by introducing a.c. coupling to the c.r. tube.

621.397.5 **924**

Television Simplified. [Book Review]—M. S. Kiver. D. Van Nostrand, New York, 1946, 369 pp. $4.75. (*Proc. Inst. Radio Engrs, W. & E.,* Oct., 1946, Vol. 34, No. 10, p. 772.)

TRANSMISSION

621.385 + 621.396.694 **925**

The VT-127-A in Amateur Transmitters.—G. L. Davies. (*QST,* Nov. 1946, Vol. 30, No. 11, pp. 33–37 . . 132.) Operating data and constructional details for using these valves in a 144-Mc/s transmitter both as the doubler valve and in push-pull as the final amplifier. Operation at audio and low frequencies is also suggested.

621.396.61 + 538.561 **926**

Electric Signals with Rectangular Frequency Spectrum.—P. Boughon & P. Jacquinot. (*C.R. Acad. Sci., Paris*, 24th June 1946, Vol. 222, No. 26, pp. 1476–1478.) An experimental and theoretical study of the production of oscillations having a uniform distribution of energy over the band ΔN, and negligible energy outside this band. The theoretical form of such oscillations is $f(t) = E_0\cos 2\pi N_0 t\,[(\sin\pi\Delta N t)/\pi\Delta N t]$ where N_0 is the mid frequency. A modulation voltage proportional to $(\sin\pi\Delta N t)/\pi\Delta N t$ was obtained by rotation of a disk in front of a photoelectric cell with a window, so that the height of the window uncovered varied as $a + (\sin\pi\Delta N t)/\pi\Delta N t$. The voltage from the cell was applied to a symmetrical modulator, balanced so as to eliminate the constant term a. The bandwidth could be varied at will by altering the speed of the disk.

621.396.61 **927**

New Transmitter for Amateur Radio.—W. Bruene & N. Hale. (*Radio News*, Nov. 1946, Vol. 36, No. 5, pp. 39 . . 111.) A general account of the Collins 30K transmitter.

621.396.61.029.5 **928**

200 Watt All-Band Transmitter.—H. D. Hooton. (*Radio News*, Nov. 1946, Vol. 36, No. 5, pp. 40–43 . . 134.) An easily constructed unit, with either crystal or v.f.o. control for the 10, 20, 40 and 80 m bands.

621.396.61.029.56/.58 **929**

Single Control in the Bandswitching Transmitter.—J. H. Harms. (*QST*, Dec. 1946, Vol. 30, No. 12, pp. 19–25 . . 128.) "A 3.5–30 Mc/s exciter with broad-band driver circuits . . . well within the electrical and mechanical capabilities of the ordinary amateur."

621.396.61.029.56/.58 **930**

What about the BC-375-E?—R.M.S. (*QST*, Dec. 1946, Vol. 30, No. 12, pp. 38–42 . . 148.) A U.S. Army aircraft transmitter, using a MOPA circuit, producing 45–75 W output over a frequency range including the 3.5- and 7-Mc/s amateur bands. Considerable modifications for satisfactory amateur use would be necessary.

621.396.619.13/.14 **931**

A New Phase-Modulation Circuit for Narrow-Band F.M. Transmission.—J. J. Babkes. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 11–15.) The circuit described uses crystals in the 3 625–3 712 kc/s range and, after eight-fold multiplication, will produce a frequency swing of 10 to 12 kc/s at 29 Mc/s. The power output is about 3.5 W.

621.396.619.13 **932**

Narrow-Band F.M. with Crystal Control.—G. W. Shuart. (*QST*, Nov. 1946, Vol. 30, No. 11, pp. 27–29.) Design and construction of a reactance modulator with crystal controlled oscillator, forming a narrow band f.m. system. With a 3.5-Mc/s AT-cut crystal there is a total frequency swing of 3 200 c/s at 28 Mc/s.

621.396.619.2 : 534.78 **933**

Let's Not Overmodulate—It isn't Necessary!—J. W. Smith & N. H. Hale. (*QST*, Nov. 1946, Vol. 30, No. 11, pp. 23–26.) Describes the use of speech clipping and filtering for more effective communication.

621.396.828.018.3 **934**

Keeping Your Harmonics at Home.—G. Grammer. (*QST*, Nov. 1946, Vol. 30, No. 11, pp. 13–19.) "A discussion of the factors in harmonic generation and radiation."

VALVES AND THERMIONICS

621.38 **935**

Flicker Effect.—A. Blanc-Lapierre. (*C. R. Acad. Sci., Paris*, 1st Oct. 1945, Vol. 221, No. 14, pp. 375–377.) Schottky attributes the effect to random modifications of the emissive property of the cathode due to fluctuations in the number of atoms adsorbed at its surface, but Surdin (3586 of 1939) has shown that the effect can also be explained by fluctuations of the number of free electrons in the metal, so that it is related to the Bernamont effect. The two points of view lead to equivalent mathematical hypotheses.

621.385 : 537.291 **936**

Deflected Beam Valves for Ultra High Frequencies.—M. R. Gavin & G. W. Warren. (*G.E.C. J.*, Aug. 1946, Vol. 14, No. 2, pp. 97–104.) The theory of transverse control of an electron beam is investigated, at frequencies where the electron transit times are comparable with the period of the alternating field. A general expression is derived for the high-frequency sensitivity of deflexion-control valves and from considerations of energy of the electrons the input resistance is deduced. In both these respects, deflexion-control valves compare favourably with grid-control valves, but high shot-noise level makes them inferior to modern high-frequency triodes as amplifiers of very small signals. A brief description is given of valves designed for frequencies up to 750 Mc/s.

621.385 : 621.396.645.029.5 **937**

Characteristics of Vacuum Tubes for Radar Intermediate Frequency Amplifiers.—G. T. Ford. (*Bell. Syst. tech. J.*, July 1946, Vol. 25, No. 3, pp. 385–407.) The important factors are merit bandwidth, noise figure, input conductance, constancy of capacitances, power consumption and physical size. The effect of valve geometry on transconductance and electrode capacitances is considered in detail for an idealized plane structure. The close spacing used ensures that any limitation due to input conductance is due to lead inductance rather than to transit time effects. The cathode emission and the valve geometry of the Western Electric 6AK5 (described in detail) are such that a noise figure of 2.8 may be obtained at 60 Mc/s with a bandwidth of 10 Mc/s.

621.385.029.63/.64 **938**

Wideband Microwave Amplifier Tube.—F.R. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 90–92.) For another account see 585 of February.

621.385.032.24 **939**

Certain Electrostatic Properties of Grid Electrodes.—V. S. Lukoshkoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 243–247. In Russian.) A conception of an ideal grid with an infinitely fine mesh is introduced, and a general theory applicable to grids of all shapes and structures in conjunction with neighbouring electrodes developed. The electrostatic field is regarded as made up of two fields, the 'far' field determined by the shape of the grid and of the neighbouring electrodes, and the 'near' field similar in its structure to that of the grid. Using these conceptions, and referring to his previous work (3394 of 1936), the author considers the triode to which all other multi-electrode types can be reduced. In all classical theories of the triode it is assumed that the field at the cathode is the same as it would be were the grid replaced by a whole electrode of the same shape and having a potential U_δ related to the grid potential U_g in accordance with formula (1). Thus the triode is reduced in effect to a diode in order to determine the cathode field. The main problem of this analysis becomes the question whether such a reduction can be used with any type of triode. It is concluded that such a reduction is justifiable only under the following two conditions: (*a*) the shape of the grid should be co-ordinated with that of the other two electrodes, and (*b*) the structure and shape of the grid should also be co-ordinated. Further possible developments of the analysis are also given.

An abstract in English was noted in 2397 of 1946.

621.385.1 + 621.396.694 **940**

Analysis of Intermittent Discharges in Valves.—J. Moussiegt. (*C. R. Acad. Sci., Paris*, 27th May 1946, Vol. 222, No. 22, pp. 1280–1282.) An explanation of the intermittent nature of the discharge in a valve, across which is connected a capacitance above a certain minimum value, is based on the fact that a portion of the voltage/current characteristic has a negative slope.

621.385.1 **941**

Current Maximum in Intermittent Functioning of Discharge Tubes.—J. Moussiegt. (*C. R. Acad. Sci., Paris*, 24th June 1946, Vol. 222, No. 26, pp. 1479–1480.) A systematic study of a commercial neon tube containing some argon. A linear relation is shown to exist between the reciprocals of the current maximum and the parallel capacitance. See also 940 above.

621.385.1.032.216 **942**

Oxide Coated Cathode Literature, 1940-1945.—J. P. Blewett. (*J. appl. Phys.*, Aug. 1946, Vol. 17, No. 8, pp. 643–647.) A brief survey with an annotated bibliography.

621.385.1.032.216 **943**

The Pulsed Properties of Oxide Cathodes.—E. A. Coomes. (*J. appl. Phys.*, Aug. 1946, Vol. 17, No. 8, pp. 647–654.) A survey of experimental results. Large electron currents are available in microsecond pulses. Sparking, which may be either current limited or voltage limited, and pulse temperature rise depend on cathode materials and life; pulse temperature rise also indicates the nature of cathode resistance. Pulsed data also provide evidence for a layer structure of the oxide cathode.

621.385.1.032.216 : 537.13 **944**

Some Cases of Interaction between Positive Ions and Metallic Surfaces.—Morgulis. (*See* 744.)

621.385.1.032.216 : 621.386.1 **945**

A Study of Oxide Cathodes by X-Ray Diffraction Methods : Part 2 — Oxide Coating Composition.—A. Eisenstein. (*J. appl. Phys.*, Aug. 1946, Vol. 17, No. 8, pp. 654–663.) An investigation of the time changes occurring in oxide cathode coating composition. Lattice constant measurements are used to detect changes in the bulk of the coating and a new method of diffraction pattern analysis gives variation of composition with depth below the surface. The effect on the thermionic emission of changes in BaO-SrO composition, which depends on the base metal used, is discussed. For part 1 see 3811 of 1946; see also 943 above and 946 below.

621.385.1.032.216 : 621.386.1 **946**

Studies of the Interface of Oxide Coated Cathodes.—A. Fineman & A. Eisenstein. (*J. appl. Phys.*, Aug. 1946, Vol. 17, No. 8, pp. 663–668.) X-ray diffraction patterns show the existence of a crystalline 'interface' compound between the base metal and the oxide coating of the cathode. This 'interface' has an anomalous resistance to microsecond pulse currents, whose value, measured with embedded probes, is shown as a function of peak current for various operating temperatures. See also 945 above.

621.385.16 **947**

The Donutron.—F. H. Crawford & M. D. Hare. (*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 200..204.) Abstract with drawings of an unpublished report by F. H. Crawford and M. D. Hare of Harvard University on a tunable squirrel cage magnetron having an output of 50 W at 45% efficiency operating in the re-entrant line mode over a frequency range of 1 to 1.5 at a single anode voltage.

621.385.16 **948**

The Internal Mechanism of the Magnetron.—J. Voge. (*Onde élect.*, Aug-Oct. 1946, Vol. 26, Nos. 233–235, pp. 345–354 & 374–386.) The steady state conditions in a non-oscillating magnetron are first considered: the importance of taking into account the initial velocity of the electrons is stressed. For voltages up to a value somewhat exceeding the critical potential, cardioid and spiral trajectories are possible. Reasons are advanced suggesting that the latter type occurs in practice. At higher potentials the cardioid type alone is obtained.

The processes involved in an oscillating magnetron are considered in part 2. Formulae are obtained for the frequencies of the possible modes of oscillation, in terms of the magnetic field and number of anode segments. The internal impedance of the magnetron is also calculated. Finally, theory and experiment are compared.

621.385.3 : 621.396.694.012.8 **949**

Theory of the Equivalent Diode.—G. B. Walker. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 5–7.) A new method, based on electrostatic considerations, is suggested whereby the equivalent diode can be uniquely determined whatever the emission velocity may be.

621.385.38 **950**

The Parallel Operation of Gasfilled Triodes.—G. Windred. (*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, pp. 337–338, 357.) By operating thyratrons in parallel, increased anode currents may be obtained. In some cases two small tubes can be more economical than one large one. Failure of one tube may cause overloading of the other. A tube replacement technique is suggested whereby a faulty tube may be replaced without interrupting the operation of the circuit. Possible methods of ensuring the simultaneous striking of both tubes are discussed.

621.385.38 **951**

Extending Thyratron Life.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 210, 212.) Abstract of a report by H. W. Gerlicher of Evans Signal Laboratory. The loss of hydrogen due to absorption by nickel parts of the tube is made good by placing within the envelope a heated capsule of titanium hydride powder.

621.385.4/.5 **952**

Tetrode *versus* Pentode.—L. Chrétien. (*Toute la Radio*, Dec. 1945, Vol. 12, No. 101, pp. 2–4..8.) The characteristics of both valves are reviewed, and it is concluded that the tetrode gives better performance for power amplification. Push-pull arrangement of tetrodes is advocated, in order to eliminate harmonics of even order.

621.385.41 **953**

Spontaneous Fluctuations in a Double-Cathode Valve.—D. K. C. MacDonald. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, p. 30.) At low temperatures (1 900–2 000°K) the ratio, β, of the 'fluctuation temperature' to the true temperature approximates to unity. The rapid rise of β at higher temperatures is difficult to explain in terms of positive ion emission.

621.385.82.029.3 : 621.395.61 **954**

High Power Thermionic Cell using Positive Ion Emission and operating in a Gaseous Medium.—S. Klein. (*C. R. Acad. Sci., Paris*, 27th May 1946, Vol. 222, No. 22, pp. 1282–1284.) Another account of the cell described in 593 of February.

621.396.615.142 **955**

Lens Effect of Alternating Fields in Velocity Modulated Valves.—P. Guénard. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 319–323.) In a velocity-modulated valve, the electric field across the gap in the modulating electrode (buncher) produces a 'lens' effect, so that an incident parallel beam of electrons is not only bunched (the normal velocity-modulation effect) but becomes alternately convergent and divergent. The effect is computed for the case of small applied fields.

621.396.615.142.2 **956**

The Theory of the Monotron.—S. Gvozdover & V. Lopukhin. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 528–536. In Russian, with English summary.) Resonant frequencies, the amplitude of stationary vibrations, the efficiency, and the minimum current required for excitation are determined for the monotron. The monotron is a single circuit klystron whose operation is based on the fact that negative impedance can be produced by passing an electron discharge between two parallel planes. The original theory of J. J. Müller (406 and 1010 of 1942) and F. B. Llewellyn (3155 of 1939) is elaborated.

621.396.69 : 389.6 **957**

Why New Valves?—F. C. Connelly. (*Murphy News*, Dec. 1946, Vol. 21, No. 12, Supplement pp. 8–10.) A description of the new B8A standard type of valve base, and comparison with former types.

621.396.69 : 389.6 **958**

Valve Standardization.—(*See* 980.)

MISCELLANEOUS

001.3 **959**

The Cultural Understanding and Appreciation of the Scientific Approach.—R. H. Ojemann. (*Science*, 11th Oct. 1946, Vol. 104, No. 2702, pp. 335–338.) Information is presented which appears to show that the vast majority of the population grow up with little real understanding of scientific principles and methods, or of the function of research in a democratic society. Causes of this situation are suggested; adequate support for research projects is unlikely unless it can be remedied.

001.4 **960**

μ is Overworked.—"Cathode Ray". (*Wireless World*, Nov. 1946, Vol. 52, No. 11, pp. 364–365.) Many examples are quoted of different and inconsistent uses of μ. It is suggested that 'μ' for 'micro-' should be used with discretion especially in magnetic formulae, and that '$\mu\mu$' should be replaced by 'p' ('pico-').

001.89 **961**

Recommendations of the Royal Society Empire Scientific Conference.—(*Sci. Culture*, Sept. 1946, Vol. 12, No. 3, pp. 117–124.) For another account see 3828 of 1946.

001.891 **962**

Research and the Smaller Firm in Britain.—(*Nature, Lond.*, 2nd Nov. 1946, Vol. 158, No. 4018, pp. 638–639.) Report of conference arranged by the Manchester Joint Research Council. Small firms were anxious to develop their own lines of research.

029 : 62 **963**

Documentation in Engineering.—M. Doucet. (*Tech. wet. Tijdschr.*, April/May 1946, Vol. 15, Nos. 4/5, pp. 27–31. In Flemish.) A Central Reference Service should be founded to provide research workers and practical engineers with all available information on any particular subject. Collaboration with existing institutions is emphasized.

029 : 778.142 **964**

Document Copying on Microfilm.—(*Nature, Lond.*, 26th Oct. 1946, Vol. 158, No. 4017, p. 579.) The importance of photographic copying is stressed, and attention is called to a new document-recording camera and microfilm reader made by W. Watson & Sons. See also 2409 of 1946 (Moholy).

5 + 6] "1939/45" **965**

The Scientist in War Time.—E. V. Appleton. (*Proc. Instn mech. Engrs*, 1946, Vol. 154, No. 3, pp. 303–316.) The thirty-second Thomas Hawksley lecture. For another account see 2420 of 1946.

519.283 **966**

Statistical Methods in Quality Control: Part 11—Statistical Tests of Significant Differences.—A.I.E.E.

Subcommittee on Educational Activities. (*Elect. Engng, N.Y.*, Oct. 1946, Vol. 65, No. 10, pp. 466–468.) Discusses the statistical interpretation of limited experimental tests. For previous parts see 2422 and 2423 of 1946 and back references.

531.715.1 : 531.717.1 : 539.23 **967**
Measurement of Thickness of Thin Films.—A. F. Gunn & R. A. Scott. (*Nature, Lond.*, 2nd Nov. 1946, Vol. 158, No. 4018, p. 621.) The film is applied over a portion of a sheet glass plate so that it has an abrupt edge, and the whole surface is coated with a thin layer of silver ; this is placed in contact with a similarly silvered glass plate. Interference fringes are formed by multiple reflection.

533.45 : 629.13.052 **968**
Barometric Measurement of Height in Aviation.—K. Ramsayer. (*Arch. tech. Messen*, June 1940, No. 108, pp. T61–62.) A brief account of aneroid barometers for height measurement in aircraft, with a detailed tabular analysis of causes of error.

538 + 531].081 : 621.39.012.8 **969**
Electrical and Mechanical Analogies.—E. B. Ferrell. (*Bell Lab. Rec.*, Oct. 1946, Vol. 24, No. 10, pp. 372–373.) A list is drawn up of quantities which play analogous parts in electrical, mechanical, and rotational problems respectively. The method of analysis by analogy has been successfully used to solve problems concerning recording and loudspeaking systems, relays, and servomechanisms.

538.3 : 001.5 **970**
The Use of Analogies.—G.W.O.H. (*Wireless Engr*, Jan. 1947, Vol. 24, No. 280, pp. 1–3.) A defence of the use of analogies in teaching the theory of electromagnetism. " The obvious way of explaining new and intangible concepts is by means of familiar and tangible concepts."

621.3.016.25 **971**
The Sign of Reactive Power.—A.I.E.E. Standards Committee. (*Elect. Engng, N.Y.*, Nov. 1946, Vol. 65, No. 11, pp. 512–516.) Some examples are quoted to support the contention that inductive reactive power should be considered positive.

621.365 **972**
Electronic Heating Conference.—(*Electronics*, Nov. 1946, Vol. 19, No. 11, pp. 184..190.) Held at San Francisco. The main subjects discussed were baking of foundry cores, and r.f. sterilization of food.

621.386.86 **973**
Invisible Industrial Hazard.—S. R. Warren, Jr. (*Elect. Engng, N.Y.*, Nov. 1946, Vol. 65, No. 11, pp. 499–507.) Excessive exposure to X rays and gamma rays can cause bodily harm months or even years later. As these rays are invisible, the urgent necessity is emphasized of warning workers of the danger, and providing adequate protection.

621.396 Bethenod **974**
The Radio Work of Joseph Bethenod.—L. Bouthillon. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 279–292.) A lecture given to the Société des Radioélectriciens to commemorate the work of Joseph Bethenod, a former president of the society.

621.396.001.6 **975**
Research and Development in Radio Technology.—R. A. Collacott. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 287–288.)

621.396/.397].6.004.67 **976**
Civic Radio Service.—(*Elect. Rev., Lond.*, 6th Dec. 1946, Vol. 139, No. 3602, p. 944.) Fulham Electricity Department will sell and service radio and television equipment, " a decision which has been followed by a number of other municipal undertakings."

621.396.615.14 **977**
The New Technique of Ultra-Short Waves.—A. V. J. Martin. (*Toute la Radio*, June 1946, Vol. 13, No. 106, pp. 153–156.) The evolution is traced from the Barkhausen-Kurz oscillator up to cavity magnetrons, klystrons and rhumbatrons.

621.396.69 : 389.6 **978**
Some Aspects of Standardisation in Radio.—T. R. W. Bushby. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1946, Vol. 7, No. 10, pp. 15–20.) National and international organizations concerned with standardization are specified. The advantages are stressed of using only sizes of components belonging to a ' preferred numbers ' series, and of specifying the standard deviation and the number of observations as well as the mean value when testing batches of similar components. The correct use of technical terms is important.

621.396.69 : 389.6 **979**
Commercial Standardisation.—(*Tech. Bull. Radio Component Mfrs' Fed.*, Aug. 1946, Vol. 1, No. 1, pp. 5–6.) A survey of the constitution and activities of the technical panels of the Federation, giving details of the draft recommendations for standardization of certain components.

621.396.69 : 389.6 **980**
Valve Standardization.—(*Wireless World*, Nov. 1946, Vol. 52, No. 11, p. 375.) Although discussion is still proceeding on standard valve types, tentative agreement has been reached that most valves will have a new small eight-pin base (type B8A) with a central spigot and a locating boss. For large-bulb valves, a base of type B8B will be used. Any further changes will be of a minor character. See also *Electronic Engng*, Nov. 1946, Vol. 18, No. 225, p. 327.

621.396.69 : 389.6 **981**
Why New Valves ?—Connelly. (*See* 957.)

621.396.96 : 001.4 **982**
What is Radar ?—" Cathode Ray ". (*See* 740.)

5 + 6] : 41.3 = 00 **983**
Dictionary of Science and Technology. [Book Review]—M. Newmark. Pitman, London, 386 pp., 30s. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, p. 219.) Intended for use in the fields of chemistry, physics and engineering. The French, German and Spanish languages are covered.

51 **984**
The Mathematical Discoveries of Newton. [Book Review]—H. W. Turnbull. Blackie, London, 1945, 68 pp., 5s. (*Beama J.*, Sept. 1946, Vol. 53, No. 111, p. 330.)

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534 + 621.395.625.3 **985**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. A Method for Changing the Frequency of a Complex Wave, by E. L. Kent. The Reduction of Background Noise in the Reproduction of Music from Records, by H. H. Scott. Recent Developments in Magnetic Recording, by R. B. Vaile, Jr. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47 . . 111.

534.321.9 : 620.179 **986**

Supersonic Flaw Detector.—J. H. J. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 198 . . 202.) 1-Mc/s quartz crystal generator to detect flaws in sheet aluminium alloy.

534.321.9.001.8 **987**

Supersonic Vibrations and Their Applications.—E. G. Richardson. (*J. R. Soc. Arts*, 3rd Jan. 1947, Vol. 95, No. 4734, pp. 90–105.)

534.62 **988**

Realization of Dead Rooms [chambres sourdes] **for Acoustic Tests.**—A. Moles. (*Radio en France*, 1946, No. 4, pp. 14–20.)

534.756 + 621.39 **989**

Theory of Communication.—Gabor. (*See* 1057.) Part 1, analysis of information; Part 2, analysis of hearing; Part 3, frequency compression and expansion.

534.851 : 621.395.813 **990**

Periodic Variations of Pitch in Sound Reproduction by Phonographs.—U. R. Furst. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 887–895.) The causes of 'wow' are discussed and an account given of the design and construction of an instrument for its measurement.

534.851 : 621.395.813 **991**

Dynamic Suppression of Phonograph Record Noise.—H. H. Scott. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 92–95.) A method of suppression of high- and low-frequency noise by automatic control of the bandwidth of an audio amplifier. Details of performance are given; a description of circuits and equipment will be published later.

534.862.4 **992**

Perfect v. Pleasing Reproduction.—Moir. (*See* 1185.)

621.395.623.73 **993**

Wide-Range Loudspeaker Developments.—H. F. Olson & J. Preston. (*J. Soc. Mot. Pict. Engrs*, Oct. 1946, Vol. 47, No. 4, pp. 327–352.) The duo-cone loudspeaker, consisting of two coaxial, congruent, separately driven cones appears to possess many advantages over other types. A detailed investigation was carried out to determine the best values of the constants of such a loudspeaker. Methods and results are described.

621.395.623.8 **994**

A Problem in Outdoor Sound.—A. B. Ellis & J. P. Gilmore. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 126–129.) High-quality amplifying equipment to cover a large open-air stage and audience.

621.395.625.6 **995**

Factors governing the Frequency Response of a Variable-Area Film Recording Channel.—M. Rettinger & K. Singer. (*J. Soc. Mot. Pict. Engrs*, Oct. 1946, Vol. 47, No. 4, pp. 299–326.)

621.396.615.1 **996**

RC Low-Frequency Generators.—(*See* 1038.)

621.396.615.11 **997**

Low-Frequency Generators.—Aschen. (*See* 1039).

621.396.645.029.3 **998**

Amplifier with Very High Musical Fidelity: Part 9.—Chrétien. (*See* 1047.)

621.396.645.029.4 **999**

Resistance Amplifiers: Part 1 — Low Frequencies.—L. Chrétien. (*Toute la Radio,* Dec. 1946, Vol. 13, No. 111, pp. 4–7.) A general treatment with special reference to the amplification of rectangular signals and the correction of phase distortion.

534.861 + 621.396.712.3 **1000**

Radio Sound Effects. [Book Review]—J. Creamer & W. B. Hoffman. Ziff-Davis Publishing Co., New York, 1945, 61 pp., $1.50. (*Proc. Inst. Radio Engrs, W. & E.,* Nov. 1946, Vol. 34, No. 11, pp. 865–866.) Gives a general background for broadcasting studio work. For another review see 1444 of 1946.

AERIALS AND TRANSMISSION LINES

621.315.2 : 621.365.5 **1001**

Low Reactance Flexible Cable for Induction Heating.—M. Zucker. (*Trans. Amer. Inst. elect. Engrs,* Dec. 1946, Vol. 65, No. 12, pp. 848–852.)

621.315.2.029.5 : 621.317.333.4 **1002**

New Methods for Locating Cable Faults, particularly on High-Frequency Cables.—F. F. Roberts. (*J. Instn elect. Engrs,* Part III, Nov. 1946, Vol. 93, No. 26, pp. 385–395. Discussion, pp. 395–404.) A theoretical survey is given of the possibilities of frequency modulation and pulse methods of locating cable faults. It is concluded that the pulse method is preferable, and in particular the d.c. pulse rather than the carrier pulse system. An instrument of the d.c. pulse type is described which gives a location accuracy of faults on coaxial cables within 1% at ranges up to 10 miles.

621.315.2.029.5 : 621.395 **1003**

High-Frequency Telephone Cables.—A. C. Holmes. (*J. Instn elect. Engrs,* Part I, Dec. 1946, Vol. 93, No. 72, p. 568.) Construction, attenuation and current transmission are discussed and the advantages of coaxial cables over waveguides indicated. At the higher frequencies coaxial cables may be limited by the problems of equalization and temperature control, with an upper limit of about 10 Mc/s and a maximum of 1 000–1 500 channels. Abstract of Chairman's address to the North Midland Student's Section of the I.E.E.

621.392 + 621.396.67 **1004**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.,* Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. The Theory and Design of Several Types of Wave Selectors, by N. I. Korman. Aircraft Antenna Pattern Measuring System, by O. Schmitt. Problems in Wide-Band Antenna Design, by A. G. Kandoian. Slot Radiators, by A. Alford. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.,* Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.392 **1005**

Wave Propagation in Curved Guides.—M. Jouguet. (*C. R. Acad. Sci., Paris,* 4th March 1946, Vol. 222, No. 10, pp. 537–538.) Expressions are derived for the field components on the assumption that the curvature does not exceed a certain value. Phase velocity and attenuation are shown to be independent of the curvature to a first approximation.

621.392 **1006**

Reflection of an Electromagnetic Wave by a Disk located in a Waveguide.—T. Kahan. (*C. R. Acad. Sci., Paris,* 24th April 1946, Vol. 222, No. 17, pp. 998–1000.) It is shown that (1) if a waveguide is terminated by an infinite section of the same cross-section, no reflection occurs and therefore no standing waves; (2) if a guide is terminated by a semi-transparent disk, whose impedance is equal to the characteristic impedance of the guide, a system of stationary waves is produced; (3) if the guide is prolonged beyond the disk by an infinite similar guide, stationary waves appear; (4) if the guide is terminated by a semi-transparent disk, with a reflection coefficient of 1/3 and whose impedance is equal to the characteristic impedance of the guide, followed by a cavity whose length is an odd number of quarter waves, no reflection occurs. See also 1795 of 1946.

621.392 : 621.396.677 **1007**

A Wide-Band Directional Coupler for Wave Guide.—H. C. Early. (*Proc. Inst. Radio Engrs, W. & E.,* Nov. 1946, Vol. 34, No. 11, pp. 883–886.) This uses a small loop responding to both electric and magnetic fields. With a special section of ridge waveguide, a two-to-one frequency range can be covered with good directional characteristics.

621.392.22 **1008**

Propagation of an Electromagnetic Signal along a Heterogeneous Line.—F. Raymond. (*C. R. Acad. Sci., Paris,* 24th April 1946, Vol. 222, No. 17, pp. 1000–1002.) A method has previously been given (2317 of 1945) for solving the equations of propagation by developments in series, introducing the idea of two waves propagated in opposite directions along the bifilar line considered. Application to the case of a discontinuity in the line results in formulae for the reflection and transmission coefficients. Equations are derived, for signals which are any functions whatever of time (t) and distance (x), expressing the law of signal variation as a function of t and x. When the line has no loss, simple results are obtained which exhibit the reflection coefficient at the discontinuity.

621.396.67 **1009**

Antennas for Circularly Polarized Waves.—(*Electronics,* Dec. 1946, Vol. 19, No. 12, p. 214.) Construction and polar diagrams for a transmitting aerial are given; the receiving aerial is briefly described. Orientation of the receiving aerial is less critical for circular than for horizontal or vertical polarization.

621.396.67 **1010**

The Wide-Band Dipole.—F. Duerden. (*Electronic Engng,* Dec. 1946, Vol. 18, No. 226, pp. 382–384.) The approximate bandwidth of a dipole is derived from a knowledge of the radiation resistance and the characteristic impedance, the latter being calculated from the dimensions. This gives a considerably greater value than can normally be expected since the impedance of the dipole changes with frequency; this causes serious mismatches in the feeding transmission line. Curves are therefore plotted of bandwidth against dipole dimensions for various values of permissible standing wave ratios.

621.396.67.011.2 **1011**

Simplifications in the Consideration of Mutual Effects between Half-Wave Dipoles in Collinear and Parallel Orientations.—K. J. Affanasiev. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 863.) Fig. 7 of this paper, omitted from 23 of January.

621.396.674 **1012**

Radiation from Large Circular Loops.—E. B. Moullin. (*J. Instn elect. Engrs*, Part I, Dec. 1946, Vol. 93, No. 72, p. 609.) Summary of 24 of January.

621.396.677 **1013**

Metal-Lens Antennas.—W. E. Kock. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 828–836.) A discussion of their properties, methods of construction and applications. The fundamental principles are given and the equations of the plate profiles are derived for both plain and stepped lenses. Index of refraction, bandwidth, tolerances and matching to the feed line must be considered in the design. Methods of construction for centimetre or metre wavelengths and of feeding by directive dipole or waveguide and horn are described. Parabolic reflectors and metal lenses are compared and possible applications of the latter are discussed. Field patterns are given for an experimental 40λ-aperture lens, used with a conical feed horn having an aperture $2\ \lambda$ in diameter, and also illustrations of several types of lens.

621.396.677 **1014**

A Practical Calculator for Directional Antenna Systems.—H. A. Ray, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 898–902.) This easily-constructed device can be used to calculate the ground and sky-wave patterns of two- and three-element arrays. The gain can be found by graphical integration.

621.396.677 **1015**

A Generalised Radiation Formula for Horizontal Rhombic Aerials : Part 3.—H. Cafferata. (*Marconi Rev.*, July/Sept. 1946, Vol. 9, No. 82, pp. 102–108.) A formula is developed which is believed to be more inclusive than those previously published and expresses the radiation in any given direction in a spherical coordinate system at large distances from the source. The source considered is that of a multiple array of horizontal rhombic elements arranged n in cascade, with m cascades in parallel and all contained in the same horizontal plane. The formula takes into account arbitrary phase relations between elements and between cascades and also includes the effect of attenuation along the conductors comprising the radiating system. Parts 1 and 2 of this article (1456 and 3188 of 1946) dealt with the development of the general formula for imperfectly conducting, and perfectly conducting earth. The list of symbols used in this development was presented in part 2 immediately adjacent to the general formulae in order to make reference as easy as possible. Part 3, now presented, deals with the derivation of formulae for particular cases representing the application of the general formula to radiation in the principal vertical and horizontal planes through the origin and principal axis of the system.

CIRCUITS AND CIRCUIT ELEMENTS

621-526 **1016**

Application of Circuit Theory to the Design of Servomechanisms.—A. C. Hall. (*J. Franklin Inst.*, Oct. 1946, Vol. 242, No. 4, pp. 279–307.) Laplace transform theory is applied to determine the response characteristics of servomechanisms and a method is given for the determination of the sensitivity. Comparison is made with the feedback amplifier. Steady-state performance and dynamical characteristics of servomechanisms are discussed and design methods given for lag-compensated networks and for circuits giving minimum steady-state errors.

621.315.2.011.3 **1017**

The Inductance of Wires and Tubes.—A. H. M. Arnold. (*J. Instn elect. Engrs*, Part II, Dec. 1946, Vol. 93, No. 36, pp. 532–540.) Maxwell's equations are used to develop formulae for the inductance of a single-phase system of wires or tubes arranged side by side or concentrically. Various functions required for numerical calculation are tabulated.

621.316.86 : 546.281.26 **1018**

Silicon Carbide Non-Ohmic Resistors.—Ashworth, Needham & Sillars. (*See* 1115.)

621.316.86.023 **1019**

High Value Deposited Resistances at High Frequency.—A. Klemt. (*Arch. tech. Messen*, Oct. 1940, No. 112, pp. T117–118.) Cylindrical or helical deposits of carbon on a ceramic base provide resistances of low temperature coefficient and small phase angle. The skin effect is negligible since the thickness of the layer is usually less than 0.1 mm which is the penetration depth in carbon at 1 000 Mc/s. The influence of internal capacitances and their loss on the apparent h.f. resistance is analysed and the possibility of compensation is discussed.

621.319.4 : 533.5 **1020**

Vacuum Condensers.—H. A. H. Griffiths. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 23–24.) Capacitors with large diameter glass-to-metal seals and of rigid cylindrical construction are described. They are much smaller in size than any other type of capacitor of equivalent rating and have low power factor and temperature coefficient of capacitance.

621.392.4 **1021**

Wideband Phase Shift Networks.—R. B. Dome. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 112–115.) Wide band characteristics are achieved by the use of two networks, each variable with frequency but having a constant phase difference. Design calculations are indicated for a pair of RC networks, which are preferable to LC. Such networks are used for single side-band telephony, for increasing transmitter efficiency, for carrier-frequency adjustment, and for frequency shift keying.

621.392.5 : 621.396.96 **1022**

Precision Resistance Networks for [fire-control] **Computer Circuits.**—E. C. Hagemann. (*Bell Lab. Rec.*, Dec. 1946, Vol. 24, No. 12, pp. 445–449.) Design and development are considered in terms of the accuracy required for use under widely varying wartime conditions.

621.392.52 **1023**

Rational Calculation of Ladder-Type Filters.—P. Coulombe. (*Bull. Soc. franç. Élect.*, March 1946, Vol. 6, No. 57, pp. 103–110.) The problem of the attenuation due to any cell in a filter can be standardized by writing it in the form $\Sigma \log \{(\mu + x)/(\mu - x)\}$, where x is a function of the frequency and μ a parameter characterizing the filter. Methods are developed, based on Tchebycheff's theory, for determining the values of μ giving the most economical filter for assigned attenuation in one or two bands.

621.392.52 **1024**

Filters and Filter Problems.—F. Locher. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1946, Vol. 24, No. 5, pp. 194–203.) A review of present day practice in the a.f. and h.f. ranges (to about 300 kc/s). Damping and loss effects are discussed and examples given of crystal filters, some using quartz and others ammonium phosphate, and of electromagnetic narrow-band a.f. filters.

621.394/.397].645 **1025**

The Cathode Follower driven by a Rectangular Voltage Wave.—M. S. McIlroy. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 848–851.) When a voltage wave is transmitted from a high-impedance source to a low-impedance load through RC coupling and a cathode follower, the position of the grid-return tap on the cathode resistor determines whether the output voltage is linearly related to the input or is affected by cut-off or overdriving. Four operating conditions are discussed, determined by the presence or absence of grid current and of plate current.

621.396 **1026**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. The Mechanical Transients Analyzer, by G. D. McCann. An Oscillographic Method of presenting Impedances on the Reflection Coefficient Plane, by A. L. Samuel. A Permeability-Tuned 100-Mc/s Amplifier of Specialized Coil Design, by Z. Benin. Very High Frequency Tuner Design, by G. Wallin & C. W. Dymond. Frequency Modulation of High-Frequency Power Oscillators, by W. R. Rambo. Design of Wide-Range Coaxial Cavity Oscillators using Reflex Klystron Tubes, by J. W. Kearney. Reflex Oscillators for Radar Systems, by J. O. McNalley & W. G. Shepherd. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.396.6.029.6 **1027**

The Interstage Auto-Transformer at Television Frequencies.—P. Feldmann. (*Electronic Engng*, Jan. 1947, Vol. 19, No. 227, pp. 21–22.) Formulae are derived for the evaluation of the stage gain of an auto-transformer coupled system and of the bandwidth of the response curve.

621.396.611 : 518.61 **1028**

Calculation of the Electromagnetic Field, Frequency and Circuit Parameters of High-Frequency Resonator Cavities.—H. Motz. (*J. Instn elect. Engrs*, Part I, Dec. 1946, Vol. 93, No. 72, pp. 610–611.) Summary of 52 of January.

621.396.611.015.33 **1029**

The Transient Response of a Tuned Circuit.—D. G. Tucker. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, pp. 379–381.) The circuit considered consists of a combination of inductance, capacitance and resistance in parallel, to which a constant current source is applied. The general differential equation

$$e/R + (1/L)\int e\,dt + C\,de/dt + B = i$$

is solved for (*a*) a d.c. applied signal, (*b*) an a.c. applied signal.

Oscillograms are given to illustrate the waveform of the solutions.

621.396.611.1 **1030**

The Relay Oscillator and Related Devices.—R. L. Ives. (*J. Franklin Inst.*, Oct. 1946, Vol. 242, No. 4, pp. 243–277.) Relay oscillators can be made to cover the frequency range 100 c/s to 10 c/hr. A simple theoretical discussion is given of such oscillators and various related circuits. Many practical examples of their application to switching, sequence of operation devices, etc., are outlined.

621.396.611.1 : 621.385.38 **1031**

Multiple Thyratron Circuits.—I. Sager. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 158..178.) It is shown that the power capabilities of thyratrons can be improved by series, series-shunt, and shunt operation. A combination circuit is described which can produce powers up to 10 MW at 30 kV.

621.396.611.1.015.33 **1032**

Effect of a Differentiating Circuit on a Sloping Wave Front.—L. S. Schwartz. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 862.) Mathematical analysis showing the importance of specifying as steep a wave front as possible for a trigger pulse used to actuate a timing circuit after passing through differentiators.

621.396.611.4 **1033**

Methods of Driving a High *Q* Cavity with Many Self-Excited Oscillators.—J. R. Woodyard, E. A. Martinelli, W. Toulis & W. K. H. Panofsky. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 447.) Discussion of the problem of driving a long cavity to be used as a linear accelerator, in the lowest longitudinal mode by a large number of oscillators. Summary of Amer. Phys. Soc. paper.

621.396.611.4 **1034**

Apertures in Cavities.—J. H. O. Harries. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 132–135.) The loading, internal field distortion, energy transfer, and leakage loss vary with the size and position of slots or apertures in resonators. The variation of these factors with slot dimensions was measured for cylindrical and rectangular resonators at λ 80 cm.

621.396.611.4 : 621.317.32 **1035**

Measurement of Electric Field Strength in a Cavity Resonant at 200 Mc/s.—Panofsky. (*See* 1131.)

621.396.611.4.012.8 **1036**

Application of the Dynamical Theory of Currents to Cavity Resonators.—A. Banos, Jr. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 448.) The equivalent circuit of a cavity is derived from the Lagrangian equations, with perturbations to include the effects of wall losses and of the external circuit. Summary of Amer. Phys. Soc. paper.

621.396.615 **1037**

Locking Phenomena in Oscillators.—Z. Jelonek. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 863.) Letter describing results given in a Polish paper published in 1938. The method of analysis is compared with that of Adler (2522 of 1946).

621.396.615.1 **1038**

RC Low-Frequency Generators.—(*Toute la Radio*, Dec. 1946, Vol. 13, No. 111, pp. 8–12.) Gives two circuits, one with continuously variable frequency and the other with a certain number of fixed frequencies.

621.396.615.11 **1039**

Low-Frequency Generators.—R. Aschen. (*Radio en France*, 1946, No. 2, pp. 3–12.) Describes, with full circuit details, the Ferisol beat-frequency oscillator and discusses, with numerous diagrams, modern RC oscillators.

621.396.615.17 : 621.317.755 **1040**

Linear Sweep Circuits.—R. P. Owen. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 136, 138.) Eight methods for the improvement of the linearity of saw-tooth generators are analysed, with typical basic circuits for a 60 c/s sweep as examples.

621.396.621 **1041**

Selectivity by Counter-Retroaction.—X. de Maistre. (*Radio en France*, 1946, No. 3, pp. 29–32.) A variable-selectivity circuit, controlled manually, or responding automatically to signal intensity variation.

621.396.64 : 621.318 **1042**

Magnetic Amplifiers.—L. Schoerer. (*Radio en France*, 1946, No. 4, pp. 24–30.) A static a.c. system, based on magnetic saturation effects.

621.396.645 **1043**

Direct-Coupled R.F. Amplifier.—E. Travis. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 154 . . 158). For amplification of signal generator output in bridge methods of aerial resistance measurement. A circuit diagram is given and advantages are indicated.

621.396.645 **1044**

Load Conditions in Class A Triode Amplifiers.—H. G. Foster. (*Electronic Engng*, Jan. 1947, Vol. 19, No. 227, pp. 11–16.) Analysis of the ideal triode shows that there is no optimum value of the load resistance, but that the power increases with increase of load resistance and in the limit is equal to half the maximum safe anode dissipation of the valve, the anode efficiency approaching 50% under Class A conditions. Methods are given for selecting the load resistance and supply voltage for particular valves. With equal supply voltages, the effective anode to anode load for two triodes in push-pull is about 50% greater than the corresponding load resistance for a single triode and the power output is about 2½ times that of the single triode.

621.396.645 **1045**

Wide-Band Amplifiers.—(*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 25–26.) Design data for 3- and 4-stage amplifiers with stagger tuning.

621.396.645 : 621.396.822 **1046**

Background Noise in Amplifiers.—Zelbstein. (*See* 1200.)

621.396.645.029.3 **1047**

Amplifier with Very High Musical Fidelity : Part 9.—L. Chrétien. (*TSF pour Tous*, Sept. 1946, Vol. 22, No. 215, pp. 176–179.) One of a series of eleven articles in *TSF pour Tous*, 1946, Vol. 22, Nos. 207–217. This part describes the complete apparatus and gives a detailed diagram ; it also recapitulates the previous articles. Parts 10 and 11 deal with assembly and testing.

621.396.645.35 **1048**

D.C. Amplifiers.—B. E. Noltingk : R. A. Lampitt. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, p. 389.) Correspondence on 679 of March.

621.396.645.35 **1049**

Electrometer Input Circuits.—H. A. Thomas. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 130–131.) It is shown theoretically that the use of negative feedback will reduce the time constant of a d.c. amplifier. A typical circuit is described and details of its performance given.

621.396.662 : 621.396.62 **1050**

The Design of Band-Spread Tuned Circuits for Broadcast Receivers.—Hughes. (*See* 1195.)

621.396.662.2 : 621.396.615.17 **1051**

Non-Linear Coils for [radar] **Pulse Generators.**—H. A. Stone, Jr. (*Bell Lab. Rec.*, Dec. 1946, Vol. 24, No. 12, pp. 450–453.) The design and operation of these coils are fully explained. Magnetron voltage of about 25 kV can be obtained from a 6-kV rectifier. The peak power of the pulse can reach 1 MW.

621.396.69 **1052**

Components.—M. Chauvierre. (*Radio en France*, 1946, No. 1, pp. 9–18.) Review of an exhibition of components, including transformers, tuning units, fixed and variable capacitors, coils and coil formers, resistors, multi-plugs and sockets, switches, etc.

621.396.694.001.8 : 621.385.5 **1053**

New Uses for Pentagrids.—A. H. Taylor. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 142 . . 154.) A pentagrid can be used as a phase inverter and a high stability single coil oscillator, to supply alternate positive and negative synchronization to a c.r.o., or to act as a variable frquency oscillator for a transmitter.

621.3.01 **1054**

Circuit Analysis by Laboratory Methods. [Book Review]—C. E. Skroder & M. S. Helm. Prentice-Hall, New York, 1946, 282 pp., $5.35. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 865.) Gives theory and general laboratory material for the study of d.c. and a.c. circuits and " is apparently intended for junior electrical engineering students ".

621.3.011.3 : 518.2 **1055**

Inductance Calculations. [Book Review]—F. W. Grover. D. Van Nostrand, New York, 1946, 286 pp., $5.75. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 865.) A collection of formulae and tables for the calculation of mutual and self inductance at low frequencies. Magnetic forces between coils are also treated and data provided for determining inductance changes as the frequency is increased.

621.396.621 **1056**

Most-Often-Needed 1946 Radio Diagrams. [Book Review]—M. N. Beitman. Supreme Publications, Chicago, 1946, 192 pp., $2.00. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 865.) An assembly of the available wiring diagrams and service information on radio-receiver models produced by approximately 40 manufacturers during the early part of 1946.

GENERAL PHYSICS

534.756 + 621.39 **1057**

Theory of Communication.—D. Gabor. (*J. Instn elect. Engrs*, Part III, Nov. 1946, Vol. 93, No. 26, pp. 429–457.) Part 1 describes a new method of analysis of signals in which there is symmetry between time and frequency, manifested in the Fourier transform relationships between the time function of the signal and its frequency spectrum. The accuracy with which the time t and frequency f can be simultaneously specified is limited by an uncertainty relation $\Delta t \Delta f \geqslant \frac{1}{2}$, which is closely linked to Heisenberg's principle of indeterminacy, and is derived by consideration of the 'effective duration' and 'effective frequency width' of the signal. This inequality defines a minimum area in the two dimensional 'information diagram' in which signals may be represented with time and frequency as coordinates. It is shown that the elementary signal which occupies this minimum area is the modulation product of a harmonic oscillation of any frequency with a pulse of the form of a probability function. Any signal can be expanded into elementary signals so that their representative areas cover the whole time-frequency area, and each elemental area, or logon, represents one quantum of information. The use of the information diagram is illustrated by two examples, a simple frequency-modulated signal, and time-division multiplex telephony. The signal which can be transmitted in the shortest time through a channel, within a specified frequency band, is shown to have a sinusoidal frequency spectrum, and its effective duration and frequency width are found.

In part 2, an analysis of hearing sensations is made, the experimental results of various observers being considered in the light of the methods of part 1. It is deduced that in the frequency range 60–1 000 c/s the human ear can discriminate nearly every second datum of information, but over the whole auditory range the efficiency is much lower since the discrimination falls off sharply at higher frequencies. Similar results obtained with signals of widely differing durations indicate that the threshold information sensitivity of the ear is independent of the duration from 20 to 250 ms, which means that the time constant of the ear appears to be adjustable over this range. To explain this it is necessary to postulate a new mechanism in the process of hearing, the nature of which is uncertain, but it is suggested that a new effect in nerve conduction may be responsible.

In part 3 the possibility is considered of transmitting audio signals in comparatively narrow wavebands by means of frequency compression in transmission and re-expansion on reception. A 'kinematical' method of doing this is described and analysed theoretically, in which a record is scanned by a succession of moving slits in front of a 'window' of continuously graded transparency, behind which is a photocell. In order to simplify the analysis, the transparency variation is taken as following a probability law, though it is shown later that under optimum conditions a triangular or trapezoidal variation would produce less noise. For a sinusoidal 'input' the reproduced signal collected by the photocell is shown to have a line spectrum consisting of all combinations of the original frequency with the slit repetition frequency. The action of the converter is shown graphically and the optimum operating conditions deduced. The full cycle of compression and re-expansion is considered and the result shown diagrammatically. It is found that the reproduction improves with increase in frequency, while the distortion occurring does so almost entirely in the expansion process.

An experimental test of the above mechanical system confirms the theoretical deductions. It is found that speech can be compressed into a frequency band as narrow as 500 c/s and still remain intelligible. Alternative kinematical methods of frequency condensation for transmission are described, of which the most convenient uses magnetic tape recorders.

In contrast, electrical methods of condensation are discussed, in which a non-sinusoidal carrier is used. The case in which a sinusoidal signal is modulated with repeated probability pulses is analysed: compression only and not expansion is possible by this method. The original signal may however be restored in the receivers by a second modulation of the same type, and it is found that distortion similar to that in the kinematical case is again produced.

535.14 **1058**

Photophysics.—M. Boll. (*Télévis. franç.*, Sept. 1946, No. 17, Supplement *Électronique*, pp. 1–2, 5.) A brief résumé of modern theory.

537 + 538 **1059**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Bunching Conditions for Electron Beams with Space Charge, by L. Brillouin. Generalized Boundary Condition in Electromagnetic Problems, by S. A. Schelkunoff. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47 . . 111.

537.523.4 **1060**

Physical Mechanism of the Spark.—S. Teszner. (*Bull. Soc. franç. Élect.*, Feb. 1946, Vol. 6, No. 56, pp. 61–80.) Consideration of the initial-stage phenomena of spark discharges shows that the theories of Townsend, Rogowski, and Loeb and Meek are not completely satisfactory, especially when the ignition is ultra-rapid. For this case an explanation is given, based on an extremely rapid passage of electrons, combined with the development of the first avalanche. A theory is also presented for the effects observed in the established regime of h.f. sparks.

537.525 : 538.551.25 **1061**

Excitation of Plasma Oscillations.—D. Bohm. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 448.) Two cases are considered : (*a*) a beam of fast electrons injected from the cathode into the plasma, and (*b*) plasma containing high-speed electrons moving at random. The energy of the resulting oscillations is deduced. Summary of Amer. Phys. Soc. paper.

537.291 : 621.396.615.14 **1062**

Induction Currents produced by Moving Electrons.—Colino. (*See* 1269.)

537.311.2 **1063**

What is Ohm's Law ?—G. W. Stubbings. (*Elect. Rev., Lond.*, 31st Jan. 1947, Vol. 140, No. 3610, pp. 225–226.) A survey of a representative sample of scientific books reveals two views of the nature of Ohm's law : (*a*) that it is virtually the assignment of a name to the E/I ratio and (*b*) that for certain materials the ratio E/I is constant and independent of I, provided all other conditions of the electric circuit remain constant.

537.533.7 : 538.245 **1064**

Forces on Ferromagnets through which Electrons are Moving.—D. L. Webster. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 446–447.) Summary of Amer. Phys. Soc. paper.

538.3 **1065**

Discovery and Title of the Elementary Law of Electromagnetism.—L. Bouthillon. (*Bull. Soc. franç. Élect.*, Nov. 1945, Vol. 5, No. 53, pp. 352–363.) A comprehensive historical review shows that the formula $dH = idl(\sin\omega)/r^2$ is due primarily to Biot, Laplace contributing to a much less extent. It is recommended that it should be known as the law of Biot and Laplace.

538.32 : 621.385.832 **1066**

An Analysis of Electromagnetic Forces.—W. A. Tripp. (*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 596–598.) Reply to criticism by A. Gronner (3253 of 1946) of an article by Tripp (587 of 1946). It is shown that the return to pre-Maxwell theory is necessary and that Gronner's relativity-cum-orthodoxy argument leads to an absurdity.

539.1 **1067**

The Nucleus of Atoms (Protons, Neutrons, Mesons).—L. Leprince-Ringuet. (*Bull. Soc. franç. Élect.*, Feb. 1946, Vol. 6, No. 56, pp. 43–55.)

539.22 **1068**

Relaxation Phenomena in Anisotropic Liquids in a Rotating Electrical Field.—V. N. Tsvetkoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, No. 1, pp. 57–67. In Russian, with English summary.) An investigation of the properties of anisotropic liquids, composed of long chain molecules, in a rotating electric field. It is found that the relaxation time in such liquids depends upon two factors, the time of polarization of a molecular group and the time of its revolution in the field. If the first of these factors is of the order of 10^{-10} sec (as is usual in polar liquids), then the second factor is a few tenths of a second for magnetic fields of several thousand gauss, or for electric fields of several c.g.s. units.

621.31 **1069**

On the Theory of Electric Contacts between Metallic Bodies.—J. Frenkel. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 4, pp. 316–325. In Russian.) An electric contact between two metals is treated as a gap which the electrons cross by the mechanism of thermionic emission. The effect of image forces is to reduce the potential difference between the two metals by an amount inversely proportional to the width of the gap. This explains why the electrical conductivity of fine metallic powders and thin layers increases with temperature according to a law similar to that for semiconductors. For full English translation see *J. Phys. U.S.S.R.*, 1945, Vol. 9, No. 6, pp. 489–495.

621.396.615.142 **1070**

Elementary Treatment of Longitudinal Debunching in a Velocity Modulation System.—Feenberg. (*See* 1272.)

531.19 **1071**

Statistical Thermodynamics. [Book Review]—E. Schrödinger. Cambridge Univ. Press ; Macmillan, New York, 1946, 86 pp., $1.50. (*Amer. J. Sci.*, Jan. 1947, Vol. 245, No. 1, p. 59.) An inquiry confined to macroscopic systems. The points of view of Boltzmann, Gibbs and Fowler are united " into one homogeneous aspect by combining the Gibbsian ensemble with the Darwin-Fowler mathematical tools ".

539 **1072**

Nucleonics. [Book Review]—Progress Press, Washington, 38 pp., $1. (*Nature, Lond.*, 23rd Nov. 1946, Vol. 158, No. 4021, p. 731.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 : 621.396.822.029.62 **1073**

Variation of Cosmic Radiation with Frequency.—L. A. Moxon. (*Nature, Lond.*, 23rd Nov. 1946, Vol. 158, No. 4021, pp. 758–759.) Results are given of measurements at 40, 90 and 200 Mc/s in Britain and in other latitudes, using directional aerials. A diagram shows the increase of aerial noise temperature from the equatorial plane of the galaxy as a function of galactic longitude from 0° to 360°. At 350° longitude noise level is found to vary approximately as f^{-3}, while the minimum noise level varies approximately as f^{-2}, where f is the frequency.

523.72 : 621.396.822.029.62/.63 **1074**

Origin of Radio-Waves from the Sun and the Stars.—M. N. Saha. (*Nature, Lond.*, 16th Nov. 1946, Vol. 158, No. 4020, pp. 717–718.) The emission of radio waves may be the result of nuclear transitions caused by the presence of a strong magnetic field. For the sodium atom two types of transition are possible ; one gives rise to metre waves for fields of a few hundred gauss, while the other gives rise to centimetre waves for fields of the order of 10^4 gauss. Similar results hold for hydrogen and various hydrides occurring in solar and stellar atmospheres. The magnetic fields in sunspots are of the right order of magnitude to produce such transitions, if the assumption of a small additional cross field is made. This theory appears to explain the observed effects on metre wavelengths at times of sunspot activity, and suggests that there may also be emission in the centimetre range. The emission of centimetre waves from the Milky Way may indicate the development of spots in some of its stars, which would probably be too small for spectroscopic observation. See also 404 and 402 of February and back references.

539.16.08 : 537.591 **1075**
Cloud Chamber for Airborne Cosmic-Ray Observations.—W. E. Hazen. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 445.) Summary of Amer. Phys. Soc. paper.

550.389 **1076**
North Magnetic Pole believed Moved 200 Miles.—(*Sci. News Lett., Wash.*, 2nd Nov. 1946, Vol. 50, No. 18, p. 280.) Recent observations indicate that the north pole is now at least 200 miles north and slightly east of its former position in Boothia peninsula.

551.510.535 : 523.746 **1077**
The Current Sunspot Trend.—H. T. Stetson. (*Sci. Mon., N.Y.*, Nov. 1946, Vol. 63, No. 5, pp. 399–402.) Description of the correlation between E-layer electron density and mean sunspot number. The next sunspot maximum should occur during the early part of 1948.

551.515.827 : 621.396.812 **1078**
Reflection of Radio Waves from Tropospheric Layers.—Smyth & Trolese. (*See* 1180.)

551.556.3 **1079**
Wind Energy : Its Value and the Search for [installation] **Sites.**—P. Ailleret. (*Rev. gén. Élect.*, March 1946, Vol. 55, No. 3, pp. 103–108.)

551.578.1 : 621.396.812 **1080**
Attenuation of 1.24-Centimeter Radiation through Rain.—Anderson, Freres, Day & Stokes. (*See* 1181.)

551.594.11 **1081**
The Definition and Theory of the Potential acquired [by a conductor] **in Atmospheric Electricity.**—R. Lecolazet. (*C. R. Acad. Sci., Paris*, 4th Feb. 1946, Vol. 222, No. 6, pp. 331–332.) A precise definition of the potential acquired by a conductor in the earth's electric field is used to develop an approximate theory of arrangements for measurement of the field.

551.594.13 : 621.317.723 **1082**
Measurement of the Electric Conductivity of the Air by a Tetrode Electrometer.—Lacaze. (*See* 1140.)

551.5(02) **1083**
Meteorology with Marine Applications. [Book Review]—W. L. Donn. McGraw-Hill, New York, 1946, 465 pp., $4.50. (*Amer. J. Sci.*, Nov. 1946, Vol. 244, No. 11, pp. 813–815.)

551.5(023) **1084**
Handbook of Meteorology. [Book Review]—E. A. Berry, Jr., E. Bollay & N. R. Beers (Eds). McGraw-Hill, New York, 1946, 1068 pp., $7.50. (*Amer. J. Sci.*, Nov. 1946, Vol. 244, No. 11, pp. 813–815.)

LOCATION AND AIDS TO NAVIGATION

621.396.9.001.8 **1085**
Guided Missiles in World War II.—Selvidge. (*See* 1171.)

621.396.93 **1086**
Frequency, Power, and Modulation for a Long-Range Radio Navigation System.—P. R. Adams & R. I. Colin. (*Elect. Commun.*, June 1946, Vol. 23, No. 2, pp. 144–158.) Ground stations must have a minimum range of 1 500 miles. All aircraft within range must receive useful signals irrespective of climatic or propagation conditions. These assumptions restrict the frequency to below 300 kc/s or between 2 and 30 Mc/s. The transmission characteristics, signal/noise ratios and aerial efficiency for the two bands are discussed and it is concluded that for maximum reliability and most economical working, the frequency should be about 70 kc/s and the aerial power 10–100 kW depending on static level and assuming a receiver bandwidth of 10–20 c/s.

There is a comprehensive bibliography.

621.396.931/.933].22.029.62 **1087**
Ultra-High-Frequency Radiosonde Direction Finding.—L. C. L. Yuan. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 852–857.) Description of a single direction-finder for measuring azimuth to within $\frac{1}{4}°$ and elevation to within $\frac{1}{2}°$ at 183 Mc/s for a fixed transmitter ; these errors are somewhat increased for a moving balloon transmitter. Measurements using Adcock and single dipole aerials are described. Various types of reflector systems for shielding a dipole aerial from ground-reflected waves were tested ; the corner reflector type of shield with a simple half-wave dipole was found to be the most effective. See also 732 of March.

621.396.932 **1088**
Electronics on World's Largest Liner.—(*See* 1222.)

621.396.933 **1089**
Second National Electronics Conference, Chicago, Autumn, 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Improvements in 75-Mc/s Aircraft Marker Systems, by B. Montgomery. Automatic Radio Flight Control, by F. L. Moseley & C. B. Watts. Naviglobe—Long Range Air Navigation System, by P. R. Adams & R. I. Colin. Teleran—Air Navigation and Traffic Control by means of Television and Radar, by D. H. Ewing & R. W. K. Smith. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47 . . 111.

621.396.933 **1090**
New Radio Beacon Methods.—E. Aisberg. (*Toute la Radio*, Nov. 1946, Vol. 13, No. 110, pp. 274–277.) A short historical survey, with discussion of the basic principles and operation of the loran system.

621.396.933 **1091**
The Block System for Airway Control.—(*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 54–56.) A method based upon railway block-signalling practice, using pulse technique for signalling codes and ensuring automatic safety on air routes.

621.396.933 **1092**

[Long and Short Range] **Aerial Navigation** [including instrument and automatic landing] **and Traffic Control with Navaglobe, Navar, Navaglide, and Navascreen.**—H. Busignies, P. R. Adams & R. I. Colin. (*Elect. Commun.*, June 1946, Vol. 23, No. 2, pp. 113–143.) Co-ordinated proposals for the step-by-step provision of these facilities over a period of years, using the minimum amount of aircraft equipment.

About 75 Navaglobe transmitters on about 100 kc/s provide equipped aircraft with fixes anywhere in the world. Each aircraft compares the amplitudes of three figure-of-eight diagrams to obtain a bearing, and two such bearings give a fix; an independent check is given by normal loop d.f.

Navar is basically a 3 000 Mc/s ground surveillance radar at each airport and provides (*a*) normal p.p.i, (*b*) p.p.i. on all aircraft carrying responders, or only on those at a selected height, (*c*) as (*b*), but on aircraft intending to land. Video signals from (*b*) are rebroadcast for display with a ground wind vector on the aircraft p.p.i. Aircraft height can be measured, identification announced by means of coded responders, and prearranged orders automatically displayed to the pilot of any selected aircraft. The rotating beam of the ground radar and a timing signal provide the pilot with azimuth, while the aircraft pulse transmitter and a ground responder give him range from the airport or from the end of the runway when using Navaglide.

Navaglide also uses the 3 000 Mc/s band to provide four signals for blind or automatic landing. Time-sharing permits these and similar signals from nearby Navaglides to use the same frequency so that only one receiver per aircraft is required. The above indications are automatically displayed to the pilot and where appropriate can be used for auto-pilot control.

Navascreen is a semi-automatic system for displaying on a large scale information about all nearby aircraft for the controllers' use. An accelerated-time device permits prediction of collisions and forecasts traffic density at the airport.

621.396.933 **1093**

The Problems of Blind Landing.—H. C. Pritchard. (*J. R. aero. Soc.*, Dec. 1946, Vol. 50, No. 432, pp. 935–958. Discussion, pp. 958–973.) A review of recently developed methods and a general discussion of the various problems involved. The methods include the American C.A.A. (see 2237 and 2655 of 1945), and S.C.S.51 systems, the G.C.A. (ground-controlled approach) system and the B.A.B.S. (beam approach beacon system). The G.C.A. system comprises a mobile ground radar equipment which determines aircraft position and gives instructions to the pilot. It also includes a search system giving the plan position of all aircraft within about 15 miles and below about 4 000 ft. In the B.A.B.S. system, aircraft transmissions are received by the ground station and re-radiated on a slightly different frequency after a short time delay, with arrangements to give on a c.r. tube in the aircraft, short and long pulses whose relative amplitudes are determined by the angular position of the aircraft relative to the runway. A continuous range indication is also given and this, together with a barometric altimeter, is relied on for vertical guidance. The provision of adequate information for vertical guidance appears to be the most difficult landing problem and some form of radio altimeter the most promising solution.

621.396.933.1.029.62 **1094**

An Ultra-High-Frequency Radio Range with Sector Identification and Simultaneous Voice.—A. Alford, A. G. Kandoian, F. J. Lundburg & C. B. Watts, Jr. (*Elect. Commun.*, June 1946, Vol. 23, No. 2, pp. 179–189.) Reprint of 932 of 1946.

621.396.96 **1095**

Minimum Detectable Radar Signal and Its Dependence upon Parameters of Radar Systems.—A. V. Haeff. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 857–861.) Discussion of the influence on the sensitivity of a pulse radar system of pulse repetition rate r, pulse length t, intermediate-frequency bandwidth B, and video bandwidth b. Experimental determination of the absolute value of the minimum pulse signal (V_{min}) detectable visually through noise is described, with the apparatus used, and the results are expressed by the formula:

$$V_{min} = \tfrac{1}{2}E_n B^{\frac{1}{2}}(1 + 1/tB)(1670/r)^{\frac{1}{4}}$$

where E_n is the noise voltage per unit of i.f. bandwidth.

621.396.96 **1096**

Radar Demonstration by Hasler A.G. at Berne.—W. Schiess. (*Tech. Mitt. schweiz. Telegr.-Teleph-Verw.*, 1st Oct. 1946, Vol. 24, No. 5, pp. 211–218.) Demonstration to representatives of the technical press of British 3-cm naval radar, and a simple explanation of radar and its operation, with some details of p.p.i. equipment.

621.396.96 : 621.392.5 **1097**

Precision Resistance Networks for [fire-control] **Computer Circuits.**—Hagemann. (*See* 1022.)

621.396.96 (43) **1098**

Great Britain's Part in the Creation of Radar.—R. W. Hallows. (*Toute la Radio*, Sept. 1946, Vol. 13, No. 108, pp. 201–203.) "Many mistaken ideas are current on the origins of radar. . . . In order to re-establish the truth, we have thought it useful to complete the study by M. Ponte (see 1099 below) . . . by another which brings to light the important contributions of British technicians."

621.396.96 (44) **1099**

French Contributions to Radar Technique.—M. Ponte. (*Toute la Radio*, Sept. 1946, Vol. 13, No. 108, pp. 204–207.) Reprint of 3290 of 1946. See also 1098 above.

621.396.96.001.8 **1100**

Radar-Guided Bomb.—(*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 186..194.) Automatic radar control for glider-type Bat bomb.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.12 **1101**

Improvements in the MacLeod Gauge.—P. Tarbès. (*Le Vide, Paris*, Jan. 1946, Vol. 1, No. 1, pp. 9–11.)

533.5 + 621.52 **1102**

Vacuum Pumps.—P. Pensa. (*Le Vide, Paris*, Jan. & March 1946, Vol. 1, Nos. 1 & 2, pp. 4–8 & 48–53.) A short historical survey, with a description of Holweck's molecular pump, various rotary oil pumps, and the principles and construction of diffusion and condensation pumps.

533.5 + 621.521] : 614.8 **1103**

Safety Arrangement for Vacuum Plant.—M. Schérer. (*C. R. Acad. Sci., Paris,* 24th April 1946, Vol. 222, No. 17, pp. 997–998.) A simple device is described which depends on the action of a magnetic field on a gaseous discharge and which can be used to operate a stopcock.

535.37 **1104**

Luminescence Processes in Zinc Sulphide Phosphors.—G. F. J. Garlick & A. F. Gibson. (*Nature, Lond.,* 16th Nov. 1946, Vol. 158, No. 4020, pp. 704–705.)

535.37 : 546.46.784 **1105**

The Fluorescence of Pure Magnesium Tungstate.—C. G. A. Hill. (*Trans. Faraday Soc.,* Nov. 1946, Vol. 42, No. 291, pp. 685–689.) Under optimum conditions of preparation, maximum fluorescence efficiency is given by the composition $MgWO_4$, the fluorescence being associated with a particular monoclinic crystal structure.

535.376 **1106**

The Light Output of Zinc Sulphide on Irradiation with Alpha Rays.—H. A. Klasens. (*Trans. Faraday Soc.,* Nov. 1946, Vol. 42, No. 291, pp. 666–668.) A critical review of the literature leads to the conclusion that the value of 80% given by Riehl is much too high, most measurements giving values of the order of 10–15%.

546.287 **1107**

Silicones, New Electrical Insulating Materials.—F. Appell. (*Rev. gén. Élect.,* March 1946, Vol. 55, No. 3, pp. 99–103.) A short account of the methods of preparation of silicone liquids, greases, rubbers and resins, also of the physical properties of the various products and their application in the electrical industry.

546.431.826 : 621.3.011.5 **1108**

Oscillograph Study of Dielectric Properties of Barium Titanate.—A. de Bretteville, Jr. (*J. Amer. ceram. Soc.,* Nov. 1946, Vol. 29, No. 11, pp. 303–307.) See also 3625 of 1946.

620.193.21 : 669.018.2.21 **1109**

Weathering — Appreciation and a Study.—G. D. Chapman. (*Light Metals,* Nov. 1946, Vol. 9, No. 106, pp. 593–608.) The significance of atmospheric corrosion of cast light alloys is reviewed and illustrated by some experimental work. The possible use of X rays to determine the type and degree of attack is demonstrated.

620.197.6 **1110**

Preventing Corrosion in Steel Chassis.—(*Wireless World,* Jan. 1947, Vol. 53, No. 1, p. 22.) Extensive corrosion tests under tropical conditions have confirmed the superiority of electrodeposited tin-zinc alloys over either metal alone. Alloys with between 50 and 80% tin show the highest corrosion resistance.

621.31 **1111**

Contacts and Contact Materials.—(*Elect. Times,* 26th Dec. 1946, Vol. 110, No. 2879, p. 841.) See also 781 of March. Notice of book published by Johnson Matthey & Co. and Mallory Metallurgical Products. Properties and tables of use for various alloys and pure materials are listed.

621.315.59 : 546.655.78 **1112**

Cerium Tungstate as a Semi-Conductor.—J. B. Nelson & J. H. McKee. (*Nature, Lond.,* 23rd Nov. 1946, Vol. 158, No. 4021, pp. 753–754.)

621.315.612.6.017.143.029.4 + 666.11 **1113**

The Application of Low Frequency Spectra to Glass Technology.—N. J. K. (*Glass Ind.,* Dec. 1946, Vol. 27, No. 12, pp. 609, 624.) Results obtained by P. Girard & P. Abadie published recently in *Bull. Inst. Verre* indicate the importance of power loss measurements at wavelengths from 1 m to 10^6 m. With rubber, a direct correlation was found between the shape of the loss curve and the mechanical properties. The results for glass suggest the possibility of similar correlation.

621.315.612.6.017.143.029.64 + 666.11 **1114**

Dielectric Properties of Glasses at Ultra-High Frequencies and Their Relation to Composition.—L. Navias & R. L. Green. (*Glass Ind.,* Dec. 1946, Vol. 27, No. 12, pp. 615, 618.) Summary of paper already noted in 452 of February.

621.316.86 : 546.281.26 **1115**

Silicon Carbide Non-Ohmic Resistors.—F. Ashworth, W. Needham & R. W. Sillars. (*J. Instn elect. Engrs,* Part I, Dec. 1946, Vol. 93, No. 72, pp. 595–598.) Discussion on 141 of January.

621.316.86.023 **1116**

High Value Deposited Resistances at High Frequency.—Klemt. (*See* 1019.)

621.318 : 539.16.08 **1117**

Magnetic Field with Small Axial Variation.—C. E. Nielsen. (*Phys. Rev.,* 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 450.) Combinations of coils, iron bars, and rings to produce the types of field required for cloud chamber experiments. Summary of Amer. Phys. Soc. paper.

621.318.23 : 539.16.08 **1118**

The Strengths of Some Model Magnets.—S. B. Jones. (*Phys. Rev.,* 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 450.) Designs of permanent magnets made of Alnico V for use with airborne cloud-chambers in cosmic ray studies. Summary of Amer. Phys. Soc. paper.

621.318.323.2.042.15.029.64 **1119**

Iron Cores at Very High Frequencies.—J. Gouveritch. (*Radio en France,* 1946, No. 4, pp. 4–8.) Describes iron-dust materials and the best core shapes to realize *Q* values up to 280 at frequencies up to 50 Mc/s.

669.296 : 621.385.032.2 **1120**

Zirconium in Electron Tubes.—Foote Mineral Co. (*Rev. sci. Instrum.,* Nov. 1946, Vol. 17, No. 11, p. 517.) Zirconium absorbs oxygen, nitrogen, and other gases at temperatures above 300°C, and may therefore be used as a continuous 'getter' for certain types of valve. It can also act as a flux in welding tungsten, molybdenum and tantalum and has a low coefficient of secondary emission. Abstract of article by G. A. Espersen in *Foote Prints,* Vol. 18, No. 1.

679.5 **1121**

Unique Plastic makes Excellent Insulator.—(*Sci. News Lett., Wash.*, 16th Nov. 1946, Vol. 50, No. 20, p. 312.) "Teflon" is unharmed by temperatures up to 300°C and can be bent without cracking at −80°C. Its losses are low even at 3 000 Mc/s and it withstands every known solvent. Summary of an address to the Society of the Plastic Industry, by E. B. Yelton.

679.5 : 621.315.616 **1122**

Plastics as Insulation.—(*Elect. Times*, 26th Dec. 1946, Vol. 110, No. 2879, pp. 837–838.) Summary and discussion of a paper read before the I.E.E. Installations Section, on The Growing Importance of Plastics in the Electrical Industry, by G. Haefely.

679.5 **1123**

Experimental Plastics and Synthetic Resins. [Book Review]—G. F. D'Alelio. J. Wiley, New York; Chapman & Hall, London, 1946, 185 pp., $3. (*Nature, Lond.*, 16th Nov. 1946, Vol. 158, No. 4020, p. 689.)

MATHEMATICS

517.54 **1124**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) An abstract is given of a paper read at the conference entitled: Conformal Transformations in Orthogonal Reference Systems, by C. S. Roys. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47 . . 111.

518.5 : 621.38 **1125**

A.C.E. The Automatic Computing Machine.—Department of Scientific and Industrial Research. (*See* 1157.)

518.61 **1126**

Nomographs.—(*Rev. sci. Instrum.*, Nov. 1946, Vol. 17, No. 11, p. 527.) A 'projected scale chart' used in conjunction with simple equations permits the construction of nomographs involving up to five variables. Developed by W. H. Burrows.

530.162 : 621.396.822 **1127**

On the First Passage Time Problem for a One-Dimensional Markoffian Gaussian Random Function.—A. J. F. Siegert. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 449.) The probability distribution of the first passage of a random variable through any given value is calculated. Summary of Amer. Phys. Soc. paper.

512.99 : 621.3 **1128**

Elementary Vectors for Electrical Engineers. [Book Review]—G. W. Stubbings. Pitman & Sons, London, 2nd edn, 6s. 6d. (*Engineering, Lond.*, 29th Nov. 1946, Vol. 162, No. 4220, p. 507.)

MEASUREMENTS AND TEST GEAR

621.3.011.3 : 389.6 **1129**

The Possibility of a Comparison of the Inductance Standards of the Various National Laboratories and the Part such a Comparison might play in Determinations of the Electromagnetic Unit of Resistance.—M. Romanowski & R. Hérou. (*Bull. Soc. franç. Élect.*, June/July 1946, Vol. 6, No. 60, pp. 355–362.)

621.317.3.029.63/.64 **1130**

Radio Measurements in the Decimetre and Centimetre Wavebands.—R. J. Clayton, J. E. Houldin, H. R. L. Lamont & W. E. Willshaw. (*J. Instn elect. Engrs*, Part III, Nov. 1946, Vol. 93, No. 26, pp. 457–459.) Discussion on 1914 of 1946.

621.317.32 : 621.396.611.4 **1131**

Measurement of Electric Field Strength in a Cavity Resonant at 200 Mc/s.—W. K. H. Panofsky. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 447.) Fields up to 25 kV/cm are determined by measurement either of magnetic field by a loop method or of electrostatic force on the diaphragm of a condenser microphone. Summary of Amer. Phys. Soc. paper.

621.317.32.027.3 **1132**

High Voltage Measurement.—(*Elect. Times*, 28th Nov. 1946, Vol. 110, No. 2875, pp. 723–724: *Electrician*, 29th Nov. 1946, Vol. 137, No. 3574, pp. 1517–1518.) Summaries of two papers by F. M. Bruce noted in 472 of February.

621.317.333.4 : 621.315.2.029.5 **1133**

New Methods for Locating Cable Faults, particularly on High-Frequency Cables.—Roberts. (*See* 1002.)

621.317.335 : 621.396.694 **1134**

Measuring Inter-Electrode Capacitances.—C. H. Young. (*Bell Lab. Rec.*, Dec. 1946, Vol. 24, No. 12, pp. 433–438.) A new type of bridge circuit with a double 3-terminal star network which can measure capacitance to within 10^{-5} pF and conductance to within 5×10^{-5} μmho.

621.317.34 : 621.396.44 **1135**

Receiver for Measurements on Carrier-Frequency Systems.—H. G. Thilo. (*Arch. tech. Messen*, Oct. 1940, No. 112, p. T108.) Receiver covering the frequency range 120–280 kc/s using a bridge-rectifier mixer circuit with a 2-stage i.f. amplifier at 350 kc/s (bandwidth about ± 10 kc/s). The circuit is arranged to measure the peak values of the modulated signal by suitable choice of time constants. Internal calibration is obtained by using the local oscillator as an i.f. generator after adjusting its amplitude to a standard value with the aid of the output voltmeter.

621.317.4.013.24 : 621.384.6 **1136**

A Method for Measuring Small Changes in Alternating Magnetic Fields.—Powell. (*See* 1160.)

621.317.44 + [621.38 : 531.765 **1137**

Electronic Meters.—(*Elect. Times*, 19th Dec. 1946, Vol. 110, No. 2878, p. 812.) Summary of two papers read before the I.E.E. Measurements Section. The first, entitled A Millisecond Chronoscope, by R. S. J. Spilsbury & A. Felton, describes an instrument on the capacitor charging principle, with a working range from 2 ms to 1 sec. The second, entitled A Sensitive Recording Magnetometer, by A. Butterworth, describes a temperature compensated instrument using the change of a.c. resistance of a mumetal wire when subjected to an axial magnetic field.

621.317.7 **1138**

Measurement Apparatus at the Paris Fair.—G. Giniaux. (*TSF pour Tous*, Sept. 1946, Vol. 22, No. 215, pp. 182–186.)

621.317.7 **1139**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. The Notch Wattmeter for Low-Level Power Measurement of Microwave Pulses, by D. F. Bowman. Microwave Frequency Stability, by A. E. Harrison. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.317.723 : 551.594.13 **1140**

Measurement of the Electric Conductivity of the Air by a Tetrode Electrometer.—J. Lacaze. (*C. R. Acad. Sci., Paris*, 20th May 1946, Vol. 222, No. 21, pp. 1242–1244.)

621.317.725 **1141**

Simple Valve Voltmeter.—H. W. Baxter. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 9–10.) The voltage to be measured is applied to a diode, with a capacitor in the anode circuit, and the rectified output from the diode is balanced by a d.c. voltage from a potential divider, using the anode current of a second valve as a balance indicator. Peak voltages up to 90 V can be measured using 9-V batteries.

621.317.73 **1142**

Z-Meter.—L. E. Packard. (*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 42–45.) This instrument measures the complex impedance of communication circuits, microphones, lines, transformers and speakers at audio frequencies, giving both impedance and phase-angle independently of frequency. Stray capacitance and coupling are rendered negligible by means of a shielded and balanced input transformer. The range of impedance is from 0.5 to 100 000 Ω and of phase-angle from +90° to −90°, over a frequency range of 30 to 20 000 c/s. The instrument will also measure R from 0.5 to 100 000 Ω, L from 5 μH to 500 H, C from 0.001 2 to 10 000 μF, the dissipation factor *D* of capacitors, and the *Q* of inductors.

621.317.76 : 389.6 **1143**

A Standard of Frequency and Its Applications.—C. F. Booth & F. J. M. Laver. (*J. Instn elect. Engrs*, Part III, Nov. 1946, Vol. 93, No. 26, pp. 427–428.) Discussion of 2973 of 1946.

621.317.76 : 389.6 **1144**

Frequency Standard.—H. Gilloux. (*Radio en France*, 1946, No. 2, pp. 13–16.) Describes a secondary frequency standard, using a 500-kc/s quartz crystal with multivibrator frequency-division stages, permitting direct frequency measurement in 1 kc/s steps to about 4 Mc/s, in 20 kc/s steps to 40 Mc/s and in 100 kc/s steps to 100 Mc/s.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

539.16.08 **1145**

An Improvement on the Copper Evaporation Geiger-Müller Counter.—P. J. G. de Vos, K. Gürgen & S. J. du Toit. (*Rev. sci. Instrum.*, Nov. 1946, Vol. 17, No. 11, p. 516.)

620.179 : 534.321.9 **1146**

Supersonic Flaw Detector.—J. H. J. (*See* 986.)

621.3 : 629.1.001.4 **1147**

Vibration Exciter for Structural Tests.—P. J. Holmes. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 96–100.) Description of electromagnetic shakers for vibration tests at mechanical resonance on aircraft structures. Circuits of carrier-type a.f. amplifier, phase shifter and phase indicator are given.

621.317.761 : 621.165 **1148**

An Electronic Frequency Meter and Speed Regulator.—E. Levin. (*Trans. Amer. Inst. elect. Engrs*, Dec. 1946, Vol. 65, No. 12, pp. 779–786.) An attachment to a steam turbine which will indicate speeds to an accuracy of the order of 0.1% and which holds the speed steady (within ± ½%) at any speed between 10 000 and 100 000 r.p.m.

621.318.572 **1149**

High Speed Pulse Recording Circuit.—B. E. Watt. (*Rev. sci. Instrum.*, Sept. 1946, Vol. 17, No. 9, pp. 338–342.) The circuits described are capable of driving a Cenco low impedance counter at rates greater than 130 counts per second. Hard valves are used, and the circuit cannot jam.

621.318.572 **1150**

Design and Operation of an Improved Counting Rate Meter.—A. Kip, A. Bousquet, R. Evans & W. Tuttle. (*Rev. sci. Instrum.*, Sept. 1946, Vol. 17, No. 9, pp. 323–333.) Design and operation of the various components, *viz.* amplifiers, pulse equalizer, integrating circuit, degenerative vacuum-tube voltmeter, and the stabilized high- and low-voltage power supplies. Practical methods with curves are developed for determining the mean counting rate and its probable error directly from the output records.

621.318.572 **1151**

Electronic Switch.—F. Haas. (*Toute la Radio*, Dec. 1946, Vol. 13, No. 111, pp. 22–23.)

621.318.572 **1152**

Current Integrator.—B. E. Watt. (*Rev. sci. Instrum.*, Sept. 1946, Vol. 17, No. 9, pp. 334–338.) An integrator for the range 50 μA to below 4×10^{-3} μA, using the author's pulse recording circuit (1149 above). The charge per count is constant to within ±2% over the entire range, and is unaffected by power supply variations.

621.335.029.52 **1153**

An Application of High Frequencies.—L. Guerrier. (*Télévis. franç.*, Sept. 1946, No. 17, Supplement *Électronique*, p. 5.) Russian experiments on traction powered by induction at 50 kc/s.

621.36 + 621.38.001.8 **1154**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Detectors for Buried Metallic Bodies, by L. F. Curtis. Electron Optics of Deflection Fields, by R. G. E. Hutter. Microwaves and Their Possible Use in High-Frequency Heating, by T. P. Kinn & J. Marcum. Ignitron Converters for Induction Heating, by R. J. Ballard & J. L. Boyer. Dielectric Preheating in the Plastics Industry, by D. E. Watts, G. F. Leland & T. N. Willcox. The Problem of Constant Frequency in Industrial High-Frequency

Generators, by E. Mittelmann. Large Electronic D.C. Motor Drives, by M. M. Morack. Electronic Speed Control of A.C. Motors, by W. H. Elliott. The Electronic Method of Contouring Control [following a master template by a tracer], by J. Morgan. Modulation of Infrared Systems for Signaling Purposes, by W. S. Huxford. Photo Detectors for Ultraviolet, Visible, and Infrared Light, by R. J. Cashman. Military Applications of Infrared Viewers, by G. E. Brown. The Use of Radioactive Materials in Clinical Diagnosis and Medical Therapy, by J. T. Wilson. The Mass Spectrometer as an Industrial Tool, by A. O. Nier. The Cathode Ray Spectrograph, by R. Feldt & C. Berkley. Some Fundamental Problems of Nuclear Power Plant Engineering, by E. T. Neubauer. An Accelerator Column for Two to Six Million Volts, by R. R. Machlett. The Betatron Accelerator applied to Nuclear Physics, by E. E. Charlton & G. C. Baldwin. The Pressuregraph, by A. Crossley. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.362 **1155**
Vacuum Thermocouples for Radiation Measurement.—F. Kerkhof. (*Arch. tech. Messen*, Oct. 1940, No. 112, pp. T115–116.) The sensitivity (deflexion for a given irradiation/mean zero fluctuation) of a vacuum thermocouple is far superior to that of a bolometer. The influence of the gas pressure, the material of the element and its blackening on the sensitivity is discussed. Some applications are given.

621.365 : 666.1 **1156**
H.F. Glass Working.—E. M. Guyer. (*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 65–67.) H.f. heating alone, or in combination with flame, simplifies many processes.

621.38 : 518.5 **1157**
A.C.E. The Automatic Computing Machine.—Department of Scientific and Industrial Research. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, pp. 372–373.) Gives some details of the Automatic Computing Engine planned at the National Physical Laboratory.

621.38 : 531.765] + 621.317.44 **1158**
Electronic Meters.—(*See* 1137.)

621.38.001.8 **1159**
Punch Press Protector.—J. Isaacs. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 101–103.) An electronic device for protecting a punch press from damage due to failure to eject disks from the die.

621.384.6 : 621.317.4.013.24 **1160**
A Method for Measuring Small Changes in Alternating Magnetic Fields.—W. M. Powell. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 444.) Method using two search coils in compensating circuit with an amplifier and c.r.o. which enables variations of 0.1 oersted to be detected, *e.g.* in a betatron or synchrotron. Summary of Amer. Phys. Soc. paper.

621.384.6 **1161**
Description of a Frequency Modulated Cyclotron and a Discussion of the Deflector Problem.—E. J. Lofgren & B. Peters. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 444.) Summary of Amer. Phys. Soc. paper.

621.384.6 **1162**
Frequency Modulation for Berkeley 37″ Cyclotron.—K. R. MacKenzie & F. H. Schmidt. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 445.) Summary of Amer. Phys. Soc. paper.

621.384.6 **1163**
Efficiency of Frequency Modulated Cyclotron.—L. Foldy & D. Bohm. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 445.) Summary of Amer. Phys. Soc. paper.

621.384.6 **1164**
Frequency Modulated Cyclotron Characteristics.—B. T. Wright & J. R. Richardson. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 445.) Summary of Amer. Phys. Soc. paper.

621.384.6 **1165**
Synchrotron Radiofrequency System.—A. C. Helmholz, J. V. Franck & J. M. Peterson. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 448.) Summary of Amer. Phys. Soc. paper.

621.385.833 **1166**
The Electrostatic Electron Microscope.—P. Grivet & H. Bruck. (*Ann. Radioélect.*, April/July 1946, Vol. 1, Nos. 4/5, pp. 293–310.) For another account see 3706 of 1946.

621.385.833 **1167**
The C.S.F. Electrostatic Microscope.—P. Grivet. (*Le Vide, Paris*, March 1946, Vol. 1, No. 2, pp. 29–47.) A general discussion of electrostatic and electromagnetic electron microscopes and a detailed description of the C.S.F. instrument, with micrographs of crystals and microbes obtained with it. For another account see 3706 of 1946 (Bruck & Grivet).

621.385.833 : 535.317.6 **1168**
Reduction of Spherical Aberration in Strong Magnetic Lenses [in electron microscope].—L. Marton & K. Bol. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 447.) Compound instead of single objective lenses are used. Summary of Amer. Phys. Soc. paper.

621.385.833 : 537.533.73 **1169**
The Universal Electron Microscope as a High Resolution Diffraction Camera.—R. G. Picard & J. H. Reisner. (*Rev. sci. Instrum.*, Nov. 1946, Vol. 17, No. 11, pp. 484–489.) Electron diffractions corresponding to spacings above 7 Å can be obtained by magnifying the camera image by means of an electron lens. A critical description is given of the modifications required to adapt an electron microscope for this purpose.

621.389 : 531.76 **1170**
Aids to Stroboscopic Measurement.—E. L. Thomas. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, pp. 369–371.) Devices to improve the accuracy and reliability of speed measurements.

621.396.9.001.8 **1171**
Guided Missiles in World War II.—H. Selvidge. (*Proc. Radio Cl. Amer.*, Oct. 1946, Vol. 23, No. 6, pp. 3–15.) An account of the principal features and methods of control of many types developed in U.S.A. and in Germany.

621.398 : 629.13 **1172**

Radio Control Systems for Guided Missiles.—S. L. Ackerman & G. Rappaport. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 86–91.) A detailed description of methods and equipments. Circuit diagrams are given, and different control techniques discussed.

537.533.7(02) **1173**

Introduction to Electron Optics. [Book Review]—V. E. Cosslett. Clarendon Press, Oxford; Oxford Univ. Press, London, 1946, 272 pp., 25s. (*Nature, Lond.*, 16th Nov. 1946, Vol. 158, No. 4020, pp. 685–686: *J. sci. Instrum.*, Dec. 1946, Vol. 23, No. 12, p. 302.)

621.385.833 **1174**

Electron Optics and the Electron Microscope. [Book Review]—V. K. Zworykin, G. A. Morton, E. G. Ramberg, J. Hillier & A. W. Vance. John Wiley & Sons, New York; Chapman & Hall, London, 1945, 766 pp., $10. (*Trans. Faraday Soc.*, Nov. 1946, Vol. 42, No. 291, pp. 702–704.) See also 1960 and 2358 of 1946. The present review is thorough, comprehensive, and critical. " . . . this book is valuable alike for its wealth of practical detail of the technique and for its mostly well-chosen presentation of the available theoretical considerations."

PROPAGATION OF WAVES

523.72 : 621.396.822.029.62/.63 **1175**

Origin of Radio-Waves from the Sun and the Stars.—Saha. (*See* 1074.)

551.510.535 : 621.396.24 **1176**

Short-Wave Long Distance Links by means of the Ionosphere.—de Gouvenain. (*See* 1211.)

551.510.535 : 621.396.24 **1177**

Application of the Theories of Indirect Propagation to the Calculation of Links using Decametre Waves.—Aubert. (*See* 1210.)

621.396.11 **1178**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) An abstract is given of a paper read at the conference entitled: Radio Propagation at Frequencies above 30 Megacycles, by K. Bullington. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.396.812 **1179**

Five Metre Propagation Characteristics.—D. W. Heightman & E. J. Williams. (*R.S.G.B. Bull.*, Jan. 1947, Vol. 22, No. 7, pp. 98–102.) Discusses chiefly tropospheric propagation of 5-m waves, with special reference to the effects of refraction, temperature inversions, humidity gradients and general weather conditions.

621.396.812 : 551.515.827 **1180**

Reflection of Radio Waves from Tropospheric Layers.—J. B. Smyth & L. G. Trolese. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 449.) Reflection coefficients are calculated for an elevated layer produced by a warm dry air mass over a cool humid air mass. Experimental data over a 90 miles-link on 52, 100 and 547 Mc/s are compared with theory. Summary of Amer. Phys. Soc. paper.

621.396.812 : 551.578.1 **1181**

Attenuation of 1.24-Centimeter Radiation through Rain.—L. J. Anderson, C. H. Freres, J. P. Day & A. P. D. Stokes. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 449.) Experimental determination over a path of 6 400 ft. A value of 0.37 db/mile/mm/hr was obtained, which is somewhat greater than the theoretical value deduced assuming incoherent scattering. Summary of Amer. Phys. Soc. paper.

621.396.812.029.64 **1182**

Measurement of the Angle of Arrival of Microwaves.—W. M. Sharpless. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 837–845.) A description of the apparatus is given and a summary of the data collected during the summer of 1944 for two short optical paths using a wavelength of $3\frac{1}{4}$ cm. The beams of two receiving aerials of width 0.36° are swept through small arcs, one vertically and the other horizontally, across the line of incoming waves. The signal level output is observed on a recorder giving an indication of the arrival direction.

The horizontal angle of arrival was found not to deviate by more than ± 0.1°, but vertical angles as much as $\frac{1}{2}$° above the true angle of elevation were measured. Observations on reflected rays from land and sea were also made and evidence of trapping for both the direct and reflected rays was obtained.

621.396.812.029.64 **1183**

Further Observations of the Angle of Arrival of Microwaves.—A. B. Crawford & W. M. Sharpless. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 845–848.) A metal lens aerial of 0.12° beam width and wavelength $1\frac{1}{4}$ cm was used. Results are compared with those for $3\frac{1}{4}$ cm described in an earlier paper (1182 above) and correlated with meteorological conditions. Six curves of modified atmospheric refractive index against height, representative of conditions over the path, were obtained daily from balloon and tower observations. A detailed analysis is given of multiple path transmission which occurred on two nights when there was definite evidence of inversions in the refractive index/height curve near the line of transmission.

621.397.81 **1184**

A Modification to Ray Theory allowing for Ground Contours.—H. P. Williams. (*Electronic Engng*, Jan. 1947, Vol. 19, No. 227, pp. 17–20.) A simple empirical law is given which, by allowing for multiple, instead of single, reflection from the ground, gives greatly improved correlation with experimental field strength curves for television transmissions on λ 7 m from Alexandra Palace to points of reception near the ground and within 20 miles. The law should be of value at metre wavelengths and whenever the points of transmission and reception are intervisible. Its application to shorter wavelengths may be open to question.

RECEPTION

534.862.4 **1185**

Perfect v. Pleasing Reproduction.—J. Moir. (*Electronic Engng*, Jan. 1947, Vol. 19, No. 227, pp. 23–27.) The results of comprehensive tests, in which a reproducer of the highest quality was used to determine the frequency range which would produce the most pleasing reproduction, indicate a decided public preference for a restricted frequency range. This optimum range is approximately 70 to 6 500 c/s, but is somewhat dependent on programme material. A similar preference appears to exist when electrical reproduction is not involved. It is suggested that the present practice of transmitting with a flat or slightly rising characteristic and providing each listener with a tone control is the correct precedure.

621.396.44 : 621.317.34 **1186**

Receiver for Measurements on Carrier-Frequency Systems.—Thilo. (*See* 1135.)

621.396.619.13 **1187**

Twelve-Channel F.M. Converter.—J. E. Young & W. A. Harris. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 110–111.) Telephone-dial selection of any of twelve stations in the new f.m. band is achieved remotely with a pre-war f.m. receiver by use of a three-valve converter in which mixer input and oscillator are tuned by preset trimmers connected to a 12-position rotary selector switch.

621.396.62 + 621.396.82 **1188**

Second National Electronics Conference, Chicago, Autumn, 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Interference between Very High Frequency Radio Communication Circuits, by W. R. Young, Jr. Front-End Design of Frequency Modulation Receivers, by C. R. Miner. A Single-Stage Frequency Modulation Detector, by W. E. Bradley. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47 . . 111.

621.396.62 **1189**

Tendencies in the Design of the Communication Type of Receiver.—G. L. Grisdale & R. B. Armstrong. (*J. Instn elect. Engrs*, Part I, Dec. 1946, Vol. 93, No. 72, p. 605.) Summary of 223 of January.

621.396.62.029.62 **1190**

The Professional Receiver.—R. Aschenbrenner. (*Radio en France*, 1946, No. 3, pp. 14–25.) Discusses in some detail the design of all the component stages of a communications receiver for the range 15–60 m.

621.396.621 **1191**

Towards the Radio Receiver De Luxe.—L. Boë. (*Radio en France*, 1946, No. 1, pp. 26–33.) Reviews the conditions for quality reproduction and discusses a circuit fulfilling them.

621.396.621 **1192**

V55R Communication Receiver.—(*Wireless World*, Jan. 1947, Vol. 53, No. 1, p. 36.) A commercial modification of the R.A.F. type R1155. A complementary unit contains a 5 m and 10 m converter.

621.396.621.029.64 **1193**

First Steps in V.H.F. Exploration. A Practical Super-Regenerative Receiver.—"Cathode Ray". (*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 15–17.) Details of a simple set of high sensitivity and low selectivity, permitting easy tuning.

621.396.662 : 621.396.62 **1194**

Tuning Devices for Broadcast Radio Receivers.—R. C. G. Williams. (*J. Instn elect. Engrs*, Part III, Nov. 1946, Vol. 93, No. 26, pp. 405–423. Discussion, pp. 423–427.) A historical discussion of tuning device evolution is followed by a description of listening tests on the degree of mistuning required for observable deterioration of quality. As a result of these a target tolerance of 1 kc/s for long and medium waves and 2 kc/s for short waves is suggested. Problems of design imposed by these criteria are discussed together with detailed descriptions of the chief systems of preset tuning and bandspreading hitherto used. In an appendix experimental measurements of the effect of mistuning on audio-frequency response and harmonic distortion are described, and a theoretical analysis of the problem is given.

621.396.662 : 621.396.62 **1195**

The Design of Band-Spread Tuned Circuits for Broadcast Receivers.—D. H. Hughes. (*J. Instn elect. Engrs*, Part III, Nov. 1946, Vol. 93, No. 26, pp. 459–460.) Discussion of 1803 of 1946.

621.396.822 **1196**

Noise Factor : Part 2. Methods of Measurement. Sources of Test Signals.—L. A. Moxon. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 11–14.) Either a c.w. signal generator or a noise source can be used, and the latter is preferable. The most satisfactory noise source is a temperature-limited diode with a pure tungsten filament. For measurements in the 3 000–10 000 Mc/s range, the filament is mounted axially in a small-bore copper tube about 10 cm long. The correction factors for various possible errors can then be calculated. For part 1, see 864 of March.

621.396.822 : 530.162 **1197**

On the First Passage Time Problem for a One-Dimensional Markoffian Gaussian Random Function.—Siegert. (*See* 1127.)

621.396.822 : 621.396.619.16 **1198**

Pulse Distortion : the Probability Distribution of Distortion Magnitudes due to Inter-Channel Interference in Multi-Channel Pulse-Transmission Systems.—D. G. Tucker. (*J. Instn elect. Engrs*, Part I, Dec. 1946, Vol. 93, No. 72, pp. 611–612.) Summary of 230 of January.

621.396.822 : 621.396.621 **1199**

Note on the Theory of Noise in Receivers with Square Law Detector.—M. Kac & A. F. J. Siegert. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 449.) The probability density of the noise emerging from a receiver consisting of i.f. amplifier, detector and video amplifier, is calculated using the characteristic function method. Summary of Amer. Phys. Soc. paper.

621.396.822 : 621.396.645 **1200**

Background Noise in Amplifiers.—U. Zelbstein. (*Toute la Radio*, Dec. 1946, Vol. 13, No. 111, pp. 2–3 . . 24.) Discusses thermal and shot effects.

621.396.822.029.62 : 523.16 **1201**

Variation of Cosmic Radiation with Frequency.—Moxon. (*See* 1073.)

621.396.828 + 621.396.665 **1202**

Noise and Output Limiters : Part 2.—E. Toth.

(*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 120–125.) The operation of six types of r.f. and a.f. limiters and a f.m. discriminator for a.m. limiting are described, and the characteristics of thermionic and crystal diodes when used as limiters are considered. Series-type noise-peak limiters are recommended for modulated c.w. reception and full-wave a.f. shunt output types for c.w. reception. For part 1 see 867 of March.

STATIONS AND COMMUNICATION SYSTEMS

621.315.668.2 **1203**

The Reconstruction of Ten 305-Foot Tubular Steel Radio-Masts in Reinforced Concrete.—J. P. Harding. (*J. Instn Civil Engrs*, Dec. 1946, Vol. 27, No. 2, pp. 113–179.) An account of the encasing in reinforced concrete of the ten masts erected at Leafield in 1912 by the Marconi Company.

621.384.3 : 621.391.64 **1204**

Lamp enables Two-Way Talk over Invisible Searchlight Beam.—R. H. O. (*J. Franklin Inst.*, Oct. 1946, Vol. 242, No. 4, pp. 339–340.) A description of a ‘ talking lamp ’ using caesium vapour, which makes two-way conversation possible by means of invisible infra-red beam. Secrecy is claimed, and speech is transmitted practically instantaneously with true telephone quality at conversational speed.

621.39+534.756 **1205**

Theory of Communication.—Gabor. (*See* 1057.) Part 1, analysis of information ; Part 2, analysis of hearing ; Part 3, frequency compression and expansion.

621.394/.395]“ 1939/1945 ” **1206**

Telephony and Telegraphy.—W. G. Radley. (*J. Instn elect. Engrs*, Part I, Dec. 1946, Vol. 93, No. 72, pp. 569–576.) A review of improvements and developments in British Post Office equipment and methods in the last six years.

621.395.44 : 621.315.052.63 **1207**

Field Tests on Power-Line Carrier-Current Equipment.—R. H. Miller & E. S. Prud'homme. (*Trans. Amer. Inst. elect. Engrs*, Dec. 1946, Vol. 65, No. 12, pp. 824–827.) Tests on the Pacific Gas and Electric Company's new telephone system included a comparison of the performances of f.m. and a.m. equipment. The results are expressed graphically.

621.395.5 : 621.317.34 **1208**

Transmission Rating of Telephone Systems.—W. A. Codd. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1946, Vol. 65, No. 10, pp. 694–698.)

621.396 **1209**

Colonial Telecommunication. — (*Electrician*, 29th Nov. 1946, Vol. 137, No. 3574, pp. 1519–1520.) Summary and discussion of two papers read before the I.E.E. : The Development and Design of Colonial Telecommunication Systems and Plant, by C. Lawton, and The General Planning and Organisation of Colonial Telecommunication Systems, by V. H. Winson. For another account see *Elect. Times*, 28th Nov. 1946, Vol. 110, No. 2875, pp. 729–730.

621.396.24 : 551.510.535 **1210**

Application of the Theories of Indirect Propagation to the Calculation of Links using Decametre Waves.—R. Aubert. (*Bull. Soc. franç. Élect.*, March 1946, Vol. 6, No. 57, pp. 111–128.) A résumé is first given of the principal laws of propagation in an ionized medium. The general characteristics of the ionosphere and the seasonal variations of equivalent heights and critical frequencies are then surveyed ; from a knowledge of these and of the variations of solar activity it is possible to predict similar data for several months in advance and to deduce maximum usable frequencies for given distances.

The paper is mainly concerned with the calculation of the operating conditions for a short-wave link. This calculation involves the following factors : (*a*) The determination of the path of the wave—the angle of elevation of the ray must be as low as possible to give a minimum number of hops, but sufficient to avoid reflection at the E layer. Curves are given of minimum angle of elevation and corresponding distance per hop for a series of E-layer critical frequencies. (*b*) The determination of the maximum usable frequency for the given path—this is derived from seasonal world charts, published in Washington, which can be interpreted in terms of local time. (*c*) The choice of an optimum working frequency, usually about 20% below the maximum usable frequency to ensure greater security of communication. (*d*) The calculation of loss by reflection at the F layer—this is a function of the ratio of optimum working frequency to maximum usable frequency ; curves are given and approximations explained. (*e*) The calculation of loss by absorption in the E layer—during the day the absorption is proportional to λ^2 and is a function of the altitude of the sun ; curves proposed at the Bucharest meeting of the C.C.I.R. are reproduced. At night absorption is proportional to $\lambda^{-0.2}$ for the first 3 or 4 hours and is negligible for the later hours.

A detailed example of the use of the above data is given for the link Paris–New York, with explanations of the approximations necessary in practice.

621.396.24 : 551.510.535 **1211**

Short-Wave Long Distance Links by means of the Ionosphere.—A. de Gouvenain. (*Toute la Radio*, Nov. 1946, Vol. 13, No. 110, pp. 264–269.) Discusses the effects of the E and F layers and explains the use of ionospheric charts for the choice of optimum operational frequencies and hours of traffic. See also 1210.

621.396.324.029.3 **1212**

Multi-Channel Two-Tone Radio Telegraphy.—L. C. Roberts. (*Bell Lab. Rec.*, Dec. 1946, Vol. 24, No. 12, pp. 461–465.) This voice-frequency telegraph system can handle a large amount of traffic over a single radio frequency with comparatively low power per channel. It gives independent start-stop teletypewriter circuits which can be extended by land lines to teletypewriters situated at different places.

For two-tone transmission, one channel is used for marking and an adjacent channel at a frequency 170 c/s higher is used for spacing. Selective fading is counteracted by simultaneous transmission of the same two-tone signals on two pairs of frequencies, corresponding members of which differ by about 1 000 c/s. A channel shifter is used to enable 6 channels of the frequency-diversity system—24 tones—to be transmitted over a single radio channel.

621.396.41 : 621.396.619.16 **1213**

Pulse-Time-Modulated Multiplex Radio Relay System — Terminal Equipment.—D. D. Grieg & A. M. Levine. (*Elect. Commun.*, June 1946, Vol. 23, No. 2, pp. 159–178.) The principles and advantages of the system are explained with numerous diagrams. A description is given of the physical and electrical characteristics of the terminal equipment of a 24-channel system which takes advantage of transmission technique developed during the war.

621.396.44 **1214**

Carrier-Frequency Broadcasting. — (*Electrician*, 29th Nov. 1946, Vol. 137, No. 3574, pp. 1503–1504.) An outline description of the new Rugby wired-broadcasting system, including monitoring facilities, put into public service on 22nd Nov. 1946. Six programmes are to be made available to subscribers, over two polyvinyl chloride covered wires, by means of modulated-carrier waves of frequencies up to 200 kc/s spaced 20 kc/s apart. It is estimated that the 6-W output of the equipment is sufficient to provide for 3 000 subscribers. For another account see *Elect. Times*, 28th Nov. 1946, Vol. 110, No. 2875, p. 725.

621.396.1 : 621.396.82 **1215**

Interference Considerations affecting Channel-Frequency Assignments.—M. Reed & S. H. Moss. (*J. Instn elect. Engrs*, Part I, Dec. 1946, Vol. 93, No. 72, pp. 603–604.) Summary of 241 of January.

621.396.619.11 **1216**

Amplitude Modulated Waves.—H. Moss. (*Electronic Engng*, Dec. 1946, Vol 18, No. 226, pp. 375–378.) The theory of amplitude modulation is considered in general and sinusoidal modulation in particular. The effects of modulation index above unity, of suppressing the carrier and of attenuating one sideband are discussed and examples of oscillographic measurements of modulation depth and distortion given. For previous parts in this series see 2966 of 1946 and back references.

621.396.619.13 **1217**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Frequency Modulation of High-Frequency Power Oscillators, by W. R. Rambo. A Microwave Relay Communication System, by G. G. Gerlach. Pulse Time Multiplex Broadcasting of the Ultrahigh Frequencies, by D. D. Grieg & A. G. Kandoian. Signal Systems for Improving Railroad Safety, by K. W. Jarvis. For titles of other papers read, see other sections. For other abstracts, see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.396.645 : 621.396.7 **1218**

Remote Amplifier for Broadcast Service.—P. Wulfsberg. (*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 70–71..102.) An audio-frequency four-channel and master self-contained unit for operation with either a.c. or batteries. The gain is 92 db, and frequency response ± 1 db from 30 to 12 000 c/s; the unit gives 50 mW output with 1% or less distortion.

621.396.65.029.62/.64 : 621.396.619.16 **1219**

A Multichannel Microwave Radio Relay System.—H. S. Black, J. W. Beyer, T. J. Grieser & F. A. Polkinghorn. (*Trans. Amer. Inst. elect. Engrs*, Dec. 1946, Vol. 65, No. 12, pp. 798–806.) The AN/TRC-6 is an 8-channel relay system operating at about 5 000 Mc/s. Sharp beaming and the complete absence of interference greatly reduce the required transmitter power. "Short pulses of microwave power carry the intelligence of the eight messages utilizing pulse position modulation to modulate the pulses and time division to multiplex the channels."

The eight high-grade telephone circuits can be used for various purposes. Two-way transmissions over distances of 1 600 miles and one-way over 3 200 miles have been achieved. See also 2315 of 1946 and back references.

621.396.712.3 **1220**

Studio Control Unit.—N. J. Peterson. (*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 68–69, 109.) All controls and amplifiers for one or two broadcasting studios, together with announcing booth, contained in a single desk cabinet.

621.396.93 **1221**

Frequency, Power and Modulation for a Long-Range Radio Navigation System.—Adams & Colin. (*See* 1086.)

621.396.932 **1222**

Electronics on World's Largest Liner.—(*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 84–85.) Navigational aids aboard the liner Queen Elizabeth include radar, loran, depth-sounding and radio installations.

621.396.712 **1223**

Broadcasting Stations of the World. [Book Review]—"Wireless World," Iliffe & Sons, London, 1s. (*Elect. Rev., Lond.*, 7th Feb. 1947, Vol. 140, No. 3611, p. 264.) Details of over a thousand stations, arranged for easy reference.

SUBSIDIARY APPARATUS

621-526+621.396.016.2.029.64 **1224**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. High-Performance Demodulators for Servomechanisms, by K. E. Schreiner. Continuous-Wave Ultrahigh-Frequency Power at the 50-kW Level, by W. G. Dow & H. W. Welch. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12 pp. 46–47..111.

621.314.2.018.8 **1225**

Primary Oscillation Damper, using a Shunted Rectifier, for Transformers feeding X-Ray Tubes.—L. Maurice. (*Bull. Soc. franç. Élect.*, March 1946, Vol. 6, No. 57, pp. 98–102.)

621.314.6+621.319.4+621.383] : 669.018 **1226**

Light Alloys in Metal Rectifiers, Photocells and Condensers.—Continuing the series in *Light Metals* mentioned in 544 of February and 3768 of 1946.

(xii) July 1945, Vol. 8, No. 90, pp. 348–359.

"The properties of interleaving papers are critical, and, physically and chemically, are related to the electrode metals."

(xiii) Aug. 1945, Vol. 8, No. 91, pp. 409–414.

Summarizes practical requirements for interleaving papers.

(xiv) Sept. 1945, Vol. 8, No. 92, pp. 459–462.

A detailed survey of the electrical, chemical, physical and mechanical characteristics of impregnating media for fixed paper capacitors.

(xv) Oct. 1945, Vol. 8, No. 93, pp. 479–491.

Continuing (xiv), with particular attention to chemical properties in relationship to the metal with which impregnating media come in contact.

(xvi) Nov. 1945, Vol. 8, No. 94, pp. 559–576.

A discussion on the relationship between impregnated media and the service characteristics and life of fixed-paper capacitors.

621.316.53 **1227**

Some Technical Considerations concerning Contactors.—F. Bertholet. (*Bull. sci. Ass. Inst. electrotechn. Montefiore,* June–Aug. 1946, Vol. 59, Nos. 6–8, pp. 271–277, 319–341 & 353–381.) In 13 chapters, dealing with the magnetic circuit, shape and pressure of contacts, phenomena at make and break, arc extinction, effect of current intensity and of the connected circuits, contactors in oil, contact life and auxiliary contacts.

621.316.935.078 **1228**

Saturable Reactors for Automatic Control.—W. D. Cockrell. (*Electronic Industr.,* Dec. 1946, Vol. 5, No. 12, pp. 48–53.) Theory and application of power-control reactors using magnetic saturation effects.

621.385.4 **1229**

A Neon Stroboscopic Lamp.—(*Electronic Engng,* Dec. 1946, Vol. 18, No. 226, p. 374.) Details of construction and operation of the Ferranti Neostron Type NSP1, designed for short discharge flashes up to 250 per sec.

621.391.64 + 621.384.3 **1230**

Some Developments in Infrared Communications Components.—J. M. Fluke & N. E. Porter. (*Proc. Inst. Radio Engrs, W. & E.,* Nov. 1946, Vol. 34, No. 11, pp. 876–883.) For communication at wavelengths 0.8–1.2 μ, the most suitable source is a caesium vapour lamp; power supply for it is considered. Plastic filters are more efficient than glass but cannot operate at such a high temperature. The three main types of receiver—phosphors, electron-image tubes, and photocells—are briefly discussed.

621.392.032.53 : 533.5 **1231**

Resonant Windows for Vacuum Seals in Rectangular Wave Guides.—M. D. Fiske. (*Rev. sci. Instrum.,* Nov. 1946, Vol. 17, No. 11, pp. 478–483.) They consist of a thin dielectric plate (glass) hermetically sealed to a Fernico metal frame. They are ground for tuning, deoxidized and soldered across the guide. They may be represented by a parallel-resonant circuit shunted across a transmission line. Windows having a Q less than unity and giving 97% power transmission have been constructed. Detailed design information is given for 3 cm windows.

621.394.652 **1232**

Telegraph Manipulating Key Design.—H. J. H. Wassell. (*Marconi Rev.,* July/Sept. 1946, Vol. 9, No. 82, pp. 109–115.) Conditions to be aimed at in key design are: (*a*) small mass of moving arm, (*b*) use of a 'dead' metal for the arm, (*c*) optimum arm length, (*d*) small gap, (*e*) contacts at centre of percussion. Some detailed observations of keying methods are given, and the design of a new manipulating key is described.

669.71 + 669.721] : 621.3 **1233**

Aluminium and Magnesium in the Electrical Industries.—B. J. Brajnikoff. (*Light Metals,* Aug. & Nov. 1946, Vol. 9, Nos. 103 & 106, pp. 393–397 & 609–618.) The first article describes the application of aluminium in high-voltage capacitors with compressed-gas insulation; it is based on the researches of B. M. Hochberg and co-workers at the Leningrad Physico-Technical Institute. The second article considers modern developments of high-voltage generation for nuclear physics, X ray or industrial applications; high electrical efficiency is obtainable by using aluminium in the construction of alternators.

621.317.755 **1234**

Principes de l'Oscillographe cathodique. [Book Review]—R. Aschen & R. Gondry. Éditions Radio, Paris, 88 pp., 100 fr. (*Toute la Radio,* Nov. 1946, Vol. 13, No. 110, p. 273.)

TELEVISION AND PHOTOTELEGRAPHY

621.396.029.6 **1235**

The Interstage Auto-Transformer at Television Frequencies.—Feldmann. (*See* 1027.)

621.397.262 **1236**

Approximate Method of calculating Reflections in Television Transmission.—D. A. Bell. (*J. Instn elect. Engrs,* Part I, Dec. 1946, Vol. 93, No. 72, p. 605.) Summary of 553 of February.

621.397.3 **1237**

Choice of Definition in Television.—R. Barthélemy. (*Cah. toute la Radio,* July 1946, No. 5, pp. 2–4.) Although a 900-line scan, with a frequency band of about 15 Mc/s, causes a continuous appearance on the screen both in the horizontal and vertical directions, in the case of some image structures the vertical definition is inferior to the horizontal. Without spoiling the definition, the use of interlacing produces a striation in the greater part of the picture equal to half the number of lines.

621.397.331.2 **1238**

New Cathode-Ray Tube for Television.—(*Radio en France,* 1946, No. 2, p. 46.) The tube has an overall length of 35 cm and gives an image 12 × 16 cm. A directly heated filament takes under 1 A at 1.2 V and the normal accelerating voltage is 2 000 V, which may be increased without danger to 3 000 or 4 000 V.

621.397.5 **1239**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.,* Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Color Television — Latest State of the Art, by P. C. Goldmark. Westinghouse Color Television Studio Equipment, by D. L. Balthis. Television Transmitter for Black-and-White and Color Television, by N. Young. Stratovision System of Communication, by C. E. Nobles & W. K. Ebel. The

Electrostatic Image Dissector, by H. Salinger. The Use of Powdered Iron in Television Deflecting Circuits, by A. W. Friend. Television Equipment for Guided Missiles, by C. J. Marshall & L. Katz. Results of Field Tests on Ultrahigh-Frequency (490 Mc/s) Color Television Transmission in the New York Metropolitan Area, by W. B. Lodge. For titles of other papers read, see other sections. For other abstracts, see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.397.5 **1240**

All-Electronic Color Television.—(*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 140, 142.) A method of simultaneous colour transmission is described. With a cathode-ray tube as light source, the image is split into three colour components and directed to separate channels by a mirror system. Three separately actuated cathode-ray tubes project the received images to form a composite picture. The colour transmissions will form monochrome pictures on existing receivers, which may alternatively be adapted for full-colour reception.

621.397.5 (44) **1241**

The Conditions for the Development of Television in France and the Problem of the Line Standard.—M. Chauvierre. (*Radio en France*, 1946, No. 2, pp. 33–35.) Discusses the difficulties of starting a television service in France. It is concluded that immediate industrial development based on a 500-line standard is essential.

621.397.5 : 515.6 **1242**

Perspective and Television.—P. Philippe. (*Télévis. franç.*, April 1946, No. 12, pp. 9–11.) A discussion of perspective effects arising from differences of the points of view of camera and viewer.

621.397.611 **1243**

From the Iconoscope to the Isoscope and towards Large Screen Television.—G. Barret. (*Toute la Radio*, March/April 1946, Vol. 13, No. 104, pp. 97–98.) Principles and construction of the iconoscope and of the more recently developed R.C.A. orthiconoscope and the Compagnie des Compteurs isoscope, both of which are better adapted for screen projection.

621.397.611 : 621.383 **1244**

The Isoscope.—R. Barthélemy. (*Télévis. franç.*, May & June 1946, Nos. 13 & 14, pp. 12–14 & 3–5..23.) A method of picture analysis by means of slow electrons uses modulation of the cathode beam, near the point of impact, by photoelectric charges created by the light projected on the transparent mosaic. A beat-frequency method produces h.f. modulation of the beam, so that in the tuned output circuit the h.f. current has 100% modulation. See also 445 of 1946.

621.397.62 **1245**

Television Receiver Construction. Part 1 — Deflector Coils : General Principles.—(*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 2–5.) Constructional details for those acquainted with sound-set construction and television circuit principles.

621.397.62 **1246**

R.C.A. reveals First Electronic Color TV [television].—(*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 58–59, 103.) Three simultaneous colour modulations are used to excite three small c.r. tubes and the light from these is focused through appropriate filters on a translucent 15 inch × 20 inch screen.

621.397.62 **1247**

Problems on Theatre Television Projection Equipment : Parts 1 & 2.—A. H. Rosenthal. (*J. Televis. Soc.*, June & Sept. 1946, Vol. 4, Nos. 10 & 11, pp. 258–263 & 274–278.) Reprint of article abstracted in 461 of 1946.

621.397.62 (44) **1248**

The S.A.D.I.R. Receiver, Type R.290.—(*Radio en France*, 1946, No. 2, pp. 43–45.) A short description of the 1943 television receiver with complete circuit diagram, and details of components used.

621.397.81 **1249**

A Modification to Ray Theory allowing for Ground Contours.—Williams. (*See* 1184.)

TRANSMISSION

621.394.652 **1250**

Telegraph Manipulating Key Design.—Wassell. (*See* 1232.)

621.395.4 **1251**

Wideband Phase Shift Networks.—Dome. (*See* 1021.)

621.396.61.029.58 **1252**

Medium Power Short-Wave Telephone-Telegraph Transmitter Type T.F.S.31.—C. R. Staines. (*Marconi Rev.*, July/Sept. 1946, Vol. 9, No. 82, pp. 89–101.) Designed for use in communication circuits where rapid frequency changing is of first importance, *e.g.* aerodrome ground stations, ship-to-shore services, and point-to-point circuits. The frequency range covered is 3–22.2 Mc/s with output power 4.0–5.0 kW on telegraphy and carrier power 3.0–3.5 kW on telephony.

621.396.619.1 **1253**

Cascade Phase Shift Modulator.—M. Marks. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 104–109.) The general requirements of phase-shift modulators are discussed, and it is shown that addition of the phase shifts of a number of stages in cascade allows a lower order of frequency multiplication. The design of a six-stage modulator with low noise and distortion characteristics is described, and the procedure given for tuning the modulator and aligning the transmitter. Distortion less than 1% is claimed.

621.396.619.14 **1254**

Phase Modulation.—V. O. Stokes. (*Marconi Rev.*, July/Sept. 1946, Vol. 9, No. 82, pp. 116–122.) Phase modulation may conveniently be applied to telegraph transmitters as an anti-fading system. A modulation method using a reactance valve in one of the driven stages is described. Curves showing the amplitude of the carrier and sidebands for various modulation indices are given and a method of measuring the modulation index (for sinusoidal modulation) is described in detail with a circuit diagram of the monitor unit. The application of the system to a typical transmitter is explained. Unintentional phase modulation may be produced by a.c. heating of valves, etc. ; a special monitor unit has been developed for measuring this unwanted modulation. This unit can also be used for the separate measurement of 'amplitude noise'.

VALVES AND THERMIONICS

621.317.7.085 **1255**

" Magic Eye " Indicators [with positive feedback].—G. O. Thacker & R. Y. Walker. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 30–31.) Criticizes the construction of war-time EM2 indicators and suggests that a short grid base and flat deflector vanes are necessary for high sensitivity.

621.383 : 621.391.64 **1256**

German Photo-Cells for the Infra Red.—B.I.O.S. (*J. Televis. Soc.*, Sept. 1946, Vol. 4, No. 11, pp. 280–281.) An extract from a B.I.O.S. report by T. F. Johns, published by H.M. Stationery Office. The characteristics of lead sulphide and lead telluride photocells, and German methods of producing them, are briefly described.

621.385 + 621.396.694 **1257**

Magnetic Control of Anode Current.—C. R. Knight. (*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 72–73..108.) Details of a new diode, type 2B23, in which the anode current is controlled by an external magnetic field. An illustration is given of its use as a voltage-control amplifier and a current-limit amplifier in an electronic motor control circuit. A more stable control circuit can be made using two such diodes differentially.

621.385 **1258**

Second National Electronics Conference, Chicago, Autumn 1946.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574.) Abstracts are given of the following papers read at the conference. Trends in Cathode-Ray Oscilloscope Design, by W. L. Gaines. Production Test Facilities for High Power Tubes, by W. L. Lyndon & B. Sheren. The Cyclophon — a Multipurpose Beam Switching Tube, by J. J. Glauber, D. D. Grieg & S. Moskowitz. An All-Metal Tunable Squirrel-Cage Magnetron, by F. H. Crawford. Bunching Conditions for Electron Beams with Space Charge, by L. Brillouin. For titles of other papers read, see other sections. For other abstracts see *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.

621.385 : 389.6 **1259**

Service Valve Equivalents.—Incorporated Radio Society of Great Britain. List of commercial equivalents to service types. Booklet issued as supplement to *R.S.G.B. Bull.*, Jan. 1947, Vol. 22, No. 7.

621.385 : 533.5 **1260**

Evacuation of Mean and Low Power Transmitting Tubes.—P. Plion. (*Le Vide, Paris*, May 1946, Vol. 1, No. 3, pp. 71–78.) Discusses methods of degassing electrodes and envelopes and describes mass production evacuation methods used in France.

621.385.016.2 **1261**

Bettering Output from Power Tubes.—L. Dolinko. (*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 60–62, 104.) Improved performance by use of getter traps and graphite anodes.

621.385.029.63/.64 **1262**

The Beam Traveling-Wave Tube.—J. R. Pierce. (*Bell. Lab. Rec.*, Dec. 1946, Vol. 24, No. 12, pp. 439–442.) For other accounts see 585 and 586 of February.

621.385.029.63/.64 **1263**

Broad Band Tube.—(*Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 57, 103.) A beam travelling-wave tube giving very high gain and a bandwidth about 80 times that hitherto practicable with other microwave tubes. See also 585 and 586 of February.

621.385.032.2 : 669.296 **1264**

Zirconium in Electron Tubes.—Foote Mineral Co. (*See* 1120.)

621.385.1.032.216 **1265**

Electronic Emission of Tungsten-Caesium and Tungsten-Thorium Cathodes.—C. Biguenet. (*Le Vide, Paris*, Jan. & March 1946, Vol. 1, Nos. 1 & 2, pp. 13–20 & 54–60.) The emissive properties of a thin layer of caesium, at most mono-atomic, obtained by progressive condensation on a tungsten filament, are deduced from De Boer's theory of adsorption. By analogy it is shown that for thorium on tungsten there is an optimum thickness corresponding to at least a mono-atomic layer of thorium. Intensities corresponding to different carburation treatments are tabulated. Micrographs reveal the nature of the surface of thoriated tungsten, the formation processes and emission characteristics of which are discussed in detail.

621.385.2 **1266**

Emission-Limited Diode.—W. E. Benham. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 863.) Comment on 3885 of 1945. In the case where the ratio of the radii of the cylinders exceeds about 10, the transit time is best obtained from Scheibe's formula.

621.385.38 : 621.3.018.41 **1267**

Frequency Performance of Thyratrons.—H. H. Wittenberg. (*Trans. Amer. Inst. elect. Engrs*, Dec. 1946, Vol. 65, No. 12, pp. 843–848.)

621.385.832 **1268**

The Ion Trap in C.R. Tubes.—J. Sharpe. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, pp. 385–386.) An electron beam is always accompanied by negative ions of various types which have undesirable effects on the c.r. tube screen. Three methods for separating the ions from the beam are described, which depend on the difference in the behaviour of the ions from that of the electrons.

621.396.615.14 : 537.291 **1269**

Induction Currents produced by Moving Electrons.—A. Colino. (*Marconi Rev.*, July/Sept. 1946, Vol. 9, No. 82, p. 123.) A "simple and intuitive" treatment of Ramo's formula (131 of 1940) for induction currents due to movement of electrons in valve inter-electrode spaces.

621.396.615.141.2.032.21 **1270**

Magnetron Cathodes.—M. A. Pomerantz. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 903–910.) Thermionic emission densities and their effect on magnetron performance are considered; the technique of emission measurement, and the interpretation of results in terms of the Richardson, Langmuir-Childs and Schottky equations is discussed. Sparking, pulse temperature rise, and back bombardment are briefly considered. The essential requirements of magnetron cathodes which are thus made clear appear to be better met by a new 'sinthor' (sintered thorium oxide) cathode than by existing types.

621.396.615.142.2 **1271**

The Klystron.—A. V. J. Martin. (*Toute la Radio*, Nov. 1946, Vol. 13, No. 110, pp. 270–271.)

621.396.615.142 **1272**

Elementary Treatment of Longitudinal Debunching in a Velocity Modulation System.—E. Feenberg. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 852–855.) Plane parallel electrode systems of unlimited extent, coaxial circular systems of infinite axial length and concentric spherical systems give rectilinear motion of the electrons, with or without velocity modulation. In these cases a complete evaluation is given of the effect of space charge on the bunching process in the range of drift space where overtaking (crossing of orbits) does not occur.

621.396.645 **1273**

Load Conditions in Class A Triode Amplifiers.—Foster. (*See* 1044.)

621.396.645 : 621.396.822 **1274**

Background Noise in Amplifiers.—Zelbstein. (*See* 1200.)

621.385.3+621.396.694 **1275**

The Gas-Filled Triode. [Book Review]—G. Windred. Hulton Press, London, 1946, 72 pp., 2s. 6d. (*Nature, Lond.*, 16th Nov. 1946, Vol. 158, No. 4020, p. 689.) "Practical applications in industrial control and trigger circuits" and "a complete list of models available at the present time, with operating conditions and possible circuits."

MISCELLANEOUS

061.5 : 621.38/.39 **1276**

Electrical Communication : 1940—1945 : Part 2.—(*Elect. Commun.*, June 1946, Vol. 23, No. 2, pp. 214–240.) Developments by Federal Telecommunication Laboratories and Federal Telephone & Radio Corporation in various fields, including direction finding and aerial navigation communication equipment for radio, telephony and telegraphy, valves, rectifiers, quartz crystals and transformers. For part 1 see 3135 of 1946; in this, the U.D.C. number should read as above.

061.6 **1277**

Work of the E.R.A. [British Electrical and Allied Industries Research Association]. (*Electrician*, 7th Feb. 1947, Vol. 138, No. 3584, pp. 441–442. Editorial comment, p. 427.) A summary of the report for the twelve months ended 30th Sept. 1946. Remarkable progress has been made in the fundamental theory of dielectric breakdown, and of the general shape of resonance lines. Inadequate financial support for the activities of the Association is feared as a result of the new Electricity Bill.

081 Rutherford **1278**

The Rutherford Papers in the Library of the Cavendish Laboratory.—E. B. Bond & W. L. Bragg. (*Nature, Lond.*, 16th Nov. 1946, Vol. 158, No. 4020, p. 714.) These have been classified and cover Rutherford's scientific career from his first research papers to his last contribution in *Nature*. "A rich mine of information, not only about Rutherford himself, but also about many famous men of his time."

389.6(73) **1279**

The American Standards Association — Our Colleague in Standardization.—W. H. Crew. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1946, Vol. 34, No. 11, pp. 874–875.)

41.316.3 **1280**

French Terms of English Origin.—E. Aisberg. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, p. 21.) Some examples of French technical jargon and errors—*e.g.* "Courants de Eddy".

5 + 6] : 011 **1281**

Bulletin Analytique.—A monthly review of scientific and technical abstracts published by the Centre de Documentation du Centre National de la Recherche Scientifique, 18 rue Pierre-Curie, Paris (5^e). Each month's issue is in two sections, the first dealing with mathematics, physics, chemistry, and their applications and the second with biology and medicine. Microfilm copies of all articles mentioned are available for loan. The annual subscription is 1800 francs per section.

5 Fleming **1282**

Ambrose Fleming — His Life and Early Researches.—J. T. Macgregor-Morris. (*J. Televis. Soc.*, Sept. 1946, Vol. 4, No. 11, pp. 266–273.) The first Fleming Memorial Lecture.

5 Mandelstam **1283**

In Memory of Academician L. I. Mandelstam; 1879-1944.—(*Bull. Acad. Sci. U.R.S.S., sér phys.*, 1945, Vol. 9, Nos. 1/2, pp. 1–132. In Russian.) Double issue devoted to appreciations and surveys of the work of L. I. Mandelstam in various fields of physics and radio.

522.1(42) Greenwich **1284**

Greenwich Observatory.—W. M. Witchell. (*Weather, Lond.*, Jan. 1947, Vol. 2, No. 1, pp. 23–29.) A sketch of the functions of the Royal Observatory and of its history from its foundation in 1676 to the present time.

537+538] : 371.3 **1285**

Teaching Electricity and Magnetism.—V. P. Hessler. (*Trans. Amer. Inst. elect. Engrs*, Dec. 1946, Vol. 65, No. 12, pp. 828–833.) The importance of a full understanding of fundamental concepts is stressed. The order in which they should be taught is suggested, with careful distinction between definitions, experimental laws, and laws theoretically derived.

551.556.3 **1286**

Wind Energy : Its Value and the Search for [installation] **Sites.**—P. Ailleret. (*Rev. gén. Élect.*, March 1946, Vol. 55, No. 3, pp. 103–108.)

621.3 **1287**

The Glasgow Technical Exhibition.—(*Electronic Engng*, Jan. 1947, Vol. 19, No. 227, pp. 28–30.) A short review of some of the instruments, tools and miscellaneous items shown at the Kelvin Hall, Nov. 1946.

621.3(44) **1288**
The Role of the Société Française des Électriciens in French Electrical Activity.—R. Langlois-Berthelot. (*Bull. Soç. franc. Élect.*, April 1946, Vol. 6, No. 58, pp. 157–172.)

621.3.016.25 **1289**
Sign of Reactive Power.—F. B. Silsbee. (*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 598–599.) The definition of a quantity 'quadergy', the time integral of the reactive power, measured in kilovars, helps to reconcile the seemingly incompatible requirements that a vector diagram similar to admittance diagrams should be obtained and that an inductive circuit should be considered to absorb power. Comment on 971 of March.

621.315.3 : 389.6 **1290**
Views on the Wiring Codes.—"Supervisor." (*Electrician*, 7th Feb. 1947, Vol. 138, No. 3584, pp. 439–440.) Comment on two Codes of Practice concerning electrical installations now issued in draft form. It is felt that the Codes are too stringent for present conditions, and do not make the best use of available resources. Mains-borne radio interference should be suppressed at the source rather than by any choice of wiring system.

621.38/.39 **1291**
National Electronics Conference Papers.—(*Elect. Engng, N.Y.*, Dec. 1946, Vol. 65, No. 12, pp. 569–574 : *Electronic Industr.*, Dec. 1946, Vol. 5, No. 12, pp. 46–47..111.) Abstracts of papers to be published in the Proceedings of the second National Electronics conference. For titles of papers read at the conference, see other sections.

621.396 **1292**
Radio Amateur Call Book.—(*Wireless World*, Jan. 1947, Vol. 53, No. 1, p. 26.) Lists call signs, names and addresses in Great Britain, U.S.A., and some seventy other countries. Quarterly publication has been resumed.

621.396 : 384 **1293**
The Radio Industry from an Economic Viewpoint.—D. A. Bell. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, pp. 27–29.) A survey based on pre-war figures. Post-war exports show a large increase. The economic need of the broadcast receiver industry at the present time is for more efficient organization of production.

621.396 " 20 " **1294**
Half a Century of Radio Communications (1896–1946).—S. P. Chakravarti. (*Curr. Sci.*, Nov. 1946, Vol. 15, No. 11, pp. 299–305.)

678.1.02 **1295**
National Rubber Research at Stanford University.—(*Science*, 27th Dec. 1946, Vol. 104, No. 2713, p. 622.) An eight-month investigation to be carried out at Salinas, California, seeking to cultivate plants with high rubber content and develop economical processes for extracting the rubber.

744.34 : 621.3 **1296**
Cylindrical Draughting Machines for Electrical Diagrams, etc.—A. M. Haworth. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, p. 387.) The paper is mounted on a cylinder which can be rotated about its horizontal axis. A straight edge is provided parallel to this axis. For drawing lines at right angles the cylinder is rotated and the pencil kept fixed.

6(02) **1297**
Progress in Science. [Book Review]—W. L. Sumner. Blackwell, Oxford, 176 pp., 8s. 6d. (*Nature, Lond.*, 9th Nov. 1946, Vol. 158, No. 4019, pp. 646–647.) Survey of technical developments during the last few years, including electron applications, the electron microscope, radar, television, atomic energy, and plastics. Future applications of present-day researches are discussed. The author " has never forgotten that he has been writing for those only slightly informed of matters scientific ".

621.3 : 69 **1298**
Electricity in the Building Industry. [Book Review]—F. C. Orchard. Chapman & Hall, London, 232 pp., 15s. (*Electrician*, 6th Dec. 1946, Vol. 137, No. 3575, p. 1597.) Deals with questions of installation, workshop wiring and lighting, power costs, maintenance and research.

621.3.004.5/.6(023) **1299**
Electrician's Maintenance Manual. [Book Review]—W. E. Steward. G. Newnes, London, 144 pp., 6s. (*Electronic Engng*, Dec. 1946, Vol. 18, No. 226, p. 388.)

621.3.029.6 (02) **1300**
Hyper and Ultrahigh Frequency Engineering. [Book Review]—R. I. Sarbacher & W. A. Edson. J. Wiley & Sons, New York, 644 pp., $6.00. (*Telegr. Teleph. Age*, Dec. 1946, Vol. 64, No. 12, p. 27.) " By avoiding complex mathematical technology, the authors have succeeded in giving in an easily understood manner a complete treatment on guided waves, Maxwell's equations, u.h.f. generation and all related equipment."

621.396 **1301**
Reference Data for Radio Engineers. [Book Review]—W. L. McPherson. Standard Telephones & Cables, London. 2nd edn, 175 pp. 5s. (*Wireless World*, Jan. 1947, Vol. 53, No. 1, p. 31.)

621.396 **1302**
Reference Data for Radio Engineers. [Book Review]—Federal Telephone & Radio Corp. Publication Dept, New York, 2nd edn, 336 pp., $2.00. (*Telegr. Teleph. Age*, Nov. 1946, Vol. 64, No. 11, p. 31.) " Revised and enlarged to cover important radio technical data developed during the war."

621.396(031) **1303**
The Radio Amateur's Handbook, 1946 Edition. [Book Review]—Headquarters Staff of the American Radio Relay League. American Radio Relay League, West Hartford, Conn., 1946, 468 + 208 pp., $1.00 in U.S.A. ; $1.50 elsewhere. (*Proc. Inst. Radio Engrs., W. & E.*, Nov. 1946, Vol. 34, No. 11, p. 865.) Comparison with the preceding edition shows an expansion of the treatment of waveguides and cavity resonators and of the u.h.f. section, but about half the material on measurements is deleted.

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.232 **1304**

A Contribution to the Theory of Acoustic Radiation.—C. J. Bouwkamp. (*Philips Res. Rep.*, Aug. 1946, Vol. 1, No. 4, pp. 251–277.) Study of "the field of radiation produced by a harmonically oscillating membrane with arbitrary amplitude distribution in a closely fitting aperture of an infinite rigid plane".

534.321.9.001.8 **1305**

Supersonic Applications.—T. F. LoGiudice. (*Radio Craft*, Dec. 1946, Vol. 18, No. 3, pp. 16–17, 67.)

534.6 : 621.395.61. **1306**

Application of Regulators to Acoustic Measurements.—A. Moles. (*C. R. Acad. Sci., Paris*, 13th Jan. 1947, Vol. 224, No. 2, pp. 101–104.) The regulator described consists of a standard microphone, amplifier and detector. The microphone is electrically corrected to have a sensibly flat response curve. The voltage from the detector is used to control inversely the gain of a variable-μ pentode whose grid receives the signal from the microphone to be tested. The response curve can thus be recorded directly on a rotating drum. A block diagram of the equipment is given.

534.861 **1307**

The Acoustic Problems of Broadcasting.—R. Braillard. (*Bull. Soc. franç. Élect.*, April 1946, Vol. 6, No. 58, pp. 173–180.) In broadcasting, mere intelligibility is not sufficient. Quality reproduction is of great importance, involving detailed study not only of electro-acoustics, but also of both physiological and psychological acoustics.

621.395.61 **1308**

Rapid Method of determining the Characteristics of a Microphone.—A. Moles. (*Radio en France*, 1945, No. 4, pp. 30–33.) A comparison method using a standard electrostatic microphone. The e.m.f. from the microphone under test and that from the standard are applied, after amplification in a known ratio, to the two sets of plates of a c.r.o., both microphones being subjected to the same sound field.

621.395.616 **1309**

The Condenser Microphone.—P. G. Bordoni. (*Alta Frequenza*, Sept. 1946, Vol. 15, No. 3, pp. 167–204. In Italian, with English summary.) A general treatment, with a bibliography of 130 papers and books on the subject.

621.395.623.7 **1310**

The Acoustic Problems of Electrodynamic Loudspeakers.—E. Synek. (*Radio Tech., Vienna*, Aug./Sept. 1946, Vol. 22, Nos. 4/5, pp. 229–232.)

621.395.623.7 **1311**

Report of the Commission on Loudspeakers (Ministry of Industrial Production).—(*Radio en France*, 1945, No. 4, pp. 34–37.) General directions are given for the graphical representation of various measurements on loudspeakers; terms are defined and technical characteristics described.

621.395.623.7 **1312**

Rational Study of Loudspeakers.—A. Clausing. (*Radio en France*, 1945, No. 4, pp. 22–27.) An account of equipment for the routine testing of loudspeakers, giving frequency characteristics, directional characteristics for different frequencies, nonlinear distortion and impedance as functions of frequency.

621.395.623.7.015.3 **1313**

Loudspeaker Transient Response.—D. E. L. Shorter. (*B.B.C. Quart.*, Oct. 1946, Vol. 1, No. 3, 9 pp. Reprint.) The frequency response curve taken after the interruption of the test note may show marked resonances which are not present in the steady state. Tests were made on four types of cones with delays of 10–40 ms and the response was determined by measuring the rate of decay of the sound. Tonal coloration, glitter, and other irritating effects were found to be associated with the additional resonances. See also *Wireless World*, Dec. 1946, Vol. 52, No. 12, pp. 424–425.

621.395.623.8 **1314**

Large Electroacoustic Installations.—J. Müller-Strobel. (*Schweiz. Bauztg*, 3rd & 10th Feb. 1945, Vol. 125, Nos. 5 & 6. Reprint.) A general description of equipment manufactured by the Albiswerk Zurich A.-G. and particularly suitable for railway stations, concert halls, works, etc. A special feature of the system is automatic control of the output volume by means of a voltage derived from a microphone which picks up the noise in the room or hall where the loudspeakers are situated.

621.395.623.8 **1315**

United Nations Broadcasting and Sound System.—(*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 90–93..154.) Technical details of broadcasting and amplification equipment at Flushing Meadows and Lake Success.

621.395.667 **1316**

Three-Band Variable Equalizer.—L. D. Grignon. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 112–115.) " Provides gain or attenuation adjustment in one-db steps independently in the low-, high-, or mid-frequency bands of the audio spectrum. Applications include recording, rerecording, sound system compensation, and broadcast station equipment." For a fuller account see 1170 of 1946.

AERIALS AND TRANSMISSION LINES

621.392 + 537.291 **1317**

Electronic Amplifier formed by a Guided Wave in a Medium of High Dielectric Constant.—R. Wallauschek. (*C. R. Acad. Sci., Paris*, 20th Jan. 1947, Vol. 224, No. 3, pp. 191–193.) A wave of the longitudinal electric type (E_0) is propagated in a cylindrical guide in which almost the whole cross-section is filled with a dielectric of high permittivity. The phase velocity of the wave is thus much less than that of light. Around the electric axis of the guide is an evacuated cylinder traversed in the direction of propagation of the wave by a beam of electrons of velocity very near the phase velocity of the wave. A solution is obtained of the problem of the interaction of wave and beam in the guide. Formulae are given for the progressive waves. Four possible reflected waves are found. Two of these exist for a small range of beam velocities around the phase velocity of the primitive wave; one has increasing, the other decreasing amplitude. These two waves have a phase velocity less than the velocity of the beam. The other two waves are of constant amplitude, one progressive and the other retrogressive, and their phase velocity is greater than the electron velocity. By combining these four waves, the limiting conditions at the ends of the guide can be satisfied. *Cf.* 1330 below (Blanc-Lapierre & Lapostolle).

621.392.029.62 + 621.396.67.029.62 **1318**

Wide-Band Aerials and Transmission Lines for 20 to 85 Mc/s.—F. E. Lutkin, R. H. J. Cary & G. N. Harding. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 552–558.) Systems covering the frequency bands 20–30 Mc/s, 40–50 Mc/s and 50–85 Mc/s are described which can deal with pulse transmissions of 600 kW peak power. The aerial arrays are built up of full-wave centre-fed dipoles of wire-cage construction, with an input impedance of 600 Ω. Open-wire transmission lines are used throughout. Wire-mesh reflectors are used to obtain the horizontal polar diagram required; their effect on dipole impedance is discussed. An exponential transformer is described which simplifies the construction of arrays consisting of four full-wave dipoles, its function being to transform an impedance of 300 Ω to 600 Ω. Compensating stubs may be used to increase the bandwidth of the wide-band aerials.

621.392.029.64 **1319**

Waveguide Data.—L. E. Sherbin. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 122–124.) Curves are given of attenuation and power-carrying capacity as a function of frequency for rectangular copper waveguides of various dimensions operating in the $TE_{1,0}$ mode. Frequencies from 1 600 Mc/s to 44 000 Mc/s are covered.

621.392.029.64 **1320**

Propagation in Curved Guides.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 13th Jan. 1947, Vol. 224, No. 2, pp. 107–109.) The method of perturbation (2469 of 1946 and 16 of January) is applied to the study of $H_{0,n}$ and $E_{0,n}$ waves in a perfectly conducting circular waveguide of radius R to determine those which reduce to $E_{m,n}$ and $H_{m,n}$ waves when R increases indefinitely. The E_1' wave behaves normally, but the E_1' and H_0 waves can only exist in a perfectly conducting curved guide if in combination and with amplitudes in the ratio $\sqrt{2} : 1$, so that the transported energy is equally divided. The effect of curvature on the phase velocity of this type of wave is not, to the second order, zero. This differs from the corresponding result for a cylindrical guide as long as the curvature is finite. In an actual guide, propagation of an H_0 or E_1' wave by itself is possible provided that the curvature is sufficiently small and tends towards zero with the resistivity of the wall.

621.392.029.64 **1321**

Some Applications of the Principle of Variation of Wavelength in Wave Guides by the Internal Movement of Dielectric Sections.—G. E. Bacon & J. C. Duckworth. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 633–638.) This principle is used for loading adjustment of centimetre-wave magnetrons working into a complex load, for beam swinging in directive arrays without mechanical movement, and in switching systems.

621.392.029.64 **1322**

Discussion on " Wave Guides " [I.E.E. radiolocation convention].—(*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, p. 778.) Points raised include the effect on performance of replacement of damaged parts, and the effect on standing-wave ratio of a small frequency shift.

621.392.029.64 : 538.3 **1323**

Quasi-Stationary Field Theory and Its Application to Diaphragms and Junctions in Transmission Lines and Wave Guides.—G G Macfarlane. (*J. Instn *elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 703–719.) Calculations are made of the shunt admittance of capacitive and inductive diaphragms in strip transmission lines and rectangular waveguides. By combining quasi-stationary field theory and Babinet's principle for electromagnetism a valid result is derived for the case when the diaphragm cross-section is comparable with, or greater than, a wavelength.

621.392.029.64 : 621.317.336.6 **1324**

Standing Wave Meter.—Kallmann. (*See* 1503.)

621.392.029.64 : 621.318.572 **1325**

The Rhumbatron Wave-Guide Switch.—A. Maclese & J. Ashmead. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 700–702.) The switch operates electrically by tuning and detuning a cavity coupled to the waveguide. High switching speeds are possible and fading is consequently minimized.

621.392.029.64 : 621.396.615.141.2 **1326**

Problems and Practice in the Production of Wave-Guide Transmission Systems.—L. W. Brown. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 639–646.) The performance requirements of waveguides are considered in terms of reflections and standing-wave ratios. Careful selection or matching must be adopted rather than random choice or interchange of sections when the number of sections exceeds 2 or 3. Particular reference is made to the case of waveguides used with magnetron sources.

621.392.029.64.091 **1327**

Attenuation Curves for 2 : 1 Rectangular, Square and Circular Wave Guides.—E. O. Willoughby & E. M. Williams. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 723–724.) Graphs are given which show the relationship between frequency and physical size for various values of attenuation in copper waveguides.

621.392.029.64.091 **1328**

Calculation of Attenuation in Wave Guides.—S. Kuhn. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 663–678.) Tables and curves are derived which give the field equations and attenuation constants of rectangular and circular waveguides excited in any mode likely to be met with in practice. Field equations are expressed in terms of field impedances and of the power transmitted by the wave, by introducing the concept of 'characteristic density' of energy. The attenuation constant caused by wall losses is tabulated for the case of an air-filled copper guide. The attenuation constant and phase constant are also tabulated for the case of an enclosed dielectric of low loss; i.e., for values of tan δ below 0.1.

621.392.1 : 512.831 **1329**

Matrix Methods in Transmission-Line and Impedance Calculations.—W. H. Watson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 737–746.) An ordered exposition of methods applicable not only to calculations of the principal wave on a two-conductor transmission line, but also to all plane wave processes capable of representation in terms of transmission lines. Some new results are also indicated.

621.392.2 **1330**

The Interaction between a Progressive Wave and a Beam of Electrons of Velocity near that of the Wave.—A. Blanc-Lapierre & P. Lapostolle. (*C.R. Acad. Sci., Paris*, 13th Jan. 1947, Vol. 224, No. 2, pp. 104–105.) For an infinite line made up of discrete equal sections, the wave amplitude increases exponentially and the wave velocity is slightly lower than the beam velocity. For an infinite uniform continuous line, four waves are possible, only one of them increasing in amplitude. Such a line can be regarded as a model explaining qualitatively the phenomena of interaction in progressive-wave amplifiers.

621.392.43 **1331**

Impedance Matching by Tapered Transmission Lines.—A. W. Gent & P. J. Wallis. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 559–563.) The lines considered are coaxial, the conductors being tapered from one radius to another. Expressions are found for the impedance deviations with change of wavelength at the input of a tapered section when its far end is joined to a coaxial line terminated by its characteristic impedance. The added resistance and reactance are least when the length of the tapered section is approximately an integral multiple of $\lambda/2$. If both the outer and inner conductors are tapered, there is an optimum taper which will give unity standing-wave ratio (s.w.r.) for $\lambda/2$ sections and a s.w.r. only slightly different from unity for other lengths. If it is desired to keep the diameter of one conductor the same on both sides of the junction, the best method is to taper the two conductors in opposite ways for a half-wavelength and then in the same way, thus producing either a bulge on the inner conductor or a constriction in the outer conductor. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 58–59.

621.396.611.029.5 **1332**

Theory of Mode Separation in a Coaxial Oscillator.—P. J. Sutro. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 960–962.) An analysis of the separation of the first and third modes in a coaxial oscillator. It is shown that the difference between the two resonant lengths of one line which give these modes increases with the difference between the products of the terminating inter-electrode capacitance and the characteristic impedance for the two lines.

621.396.67 **1333**

Aerials.—K. Fränz. (*Elektrotech. Z.*, 15th June 1944, Vol. 65, Nos. 23/24, pp. 229–233.) A review of physical principles and developments, with special reference to the directional properties and impedance of various aerial arrays.

621.396.67 **1334**

The Receiving Dipole Aerial.—J. Müller-Strobel & J. Patry. (*Schweiz. Arch. angew. Wiss. Tech.*, July 1946, Vol. 12, No. 7, pp. 201–213.) An inclusive account of work previously noted in 795 and 3527 of 1945 and 22 of January.

621.396.67 **1335**

Slot Aerials and Their Relation to Complementary Wire Aerials (Babinet's Principle).—H. G. Booker. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 620–626.) Babinet's principle of complementary screens is applied to resonant slots in thin plane conducting screens. A $\lambda/2$ slot, with an impedance of about 485 Ω, has a polar diagram similar to that of a $\lambda/2$ dipole but with the directions of vibration of electric and magnetic fields interchanged. Resonant slots may be used to form linear or broadside arrays, to produce polarized waves and for band-pass filters or any similar device used in conjunction with wire aerials. With the aid of Babinet's principle, several other problems can be reduced to problems whose solutions are already known.

621.396.67 **1336**

Slot Feeders and Slot Aerials.—C. E. G. Bailey. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 615–619.) A discussion of the properties of combinations of parallel strips, slots and gaps formed by cutting narrow strips out of infinite plane conducting sheets. Equivalence and inversion theorems are established for slots and strips, and for interconnected slots and wires. These theorems are used to give an approximate solution for the radiation field of a half-wave slot.

621.396.67 **1337**

The RCA Antennalyzer—an Instrument useful in the Design of Directional Antenna Systems.—G. H. Brown & W. C. Morrison. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 992–999.) An entirely electrical instrument for deriving the radiation pattern of an aerial array of known configuration, or for determining the characteristics of an aerial array which would give a desired radiation pattern. The application is mainly to broadcast arrays with up to five vertical tower elements, each element being characterized by four parameters defining its position and the magnitude and phase of its current. These parameters are separately controllable by means of potentiometers. Radiation patterns are presented on a cathode-ray tube in either polar or rectangular coordinates.

621.396.67 : 621.317.336 **1338**

The Measured Impedance of Cylindrical Dipoles.—D. D. King. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 844–852.) The impedance characteristics of a half-dipole and image plane were measured by a resonance method for low values of the damping; for high damping a standing-wave-ratio method supplemented the resonance data. The results are shown graphically and are in good agreement with those of Brown & Woodward (2207 of 1945).

621.396.67 : 621.397.5 **1339**

Line-of-Sight Aerials [antennes de vision].—R. Tabard. (*Télévis. franç.*, Jan. & March 1946, Nos. 9 & 11, pp. 22–23 & 19, 24.) Discusses aerials of the Hertz half-wave and Marconi quarter-wave types and corresponding feeder systems.

621.396.67.029.62 : 621.396.96.029.62 **1340**

The Use of a Common Aerial for Radar Transmission and Reception on 200 Mc/s.—C. J. Banwell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 545–551.) An account of the development of a common transmitting and receiving aerial system in 1940 for the C.H.L. stations then in use for the detection of low-flying aircraft. Bridge systems and switching systems are described and the diode-switching and spark-gap switching systems discussed in detail. The spark-gap finally adopted consisted of tungsten electrodes covered by a glass and ceramic sleeve and enclosed in a glass envelope. The filling was argon at a pressure of about ¾ atmosphere, with a small quantity of liquid mercury. The breakdown voltage was about 800 V and the design gave a reasonable life for pulse transmitter powers up to 120 kW, with rapid deionization, this being important if short-range echoes were to be obtained. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 54–55.

621.396.67.029.62 : 621.396.96.029.62 **1341**

The Design and Positioning of Aircraft Radar Aerials for Metric Wavelengths.—B. Russell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 567–574.) A discussion of the various problems involved in connection with aircraft aerials for all-round-looking, homing and search, and an account of design, positioning technique and rapid switching arrangements.

621.396.67.029.63/.64 **1342**

The Use of Spherical Reflectors as Microwave Scanning Aerials.—J. Ashmead & A. B. Pippard. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 627–632.) The conditions are discussed under which spherical surfaces can be used for wide angle scanning, while maintaining minimum deterioration in the radiation pattern. A reflector is described which produces a beam width of less than 1° at half-power and which can be scanned through 6° at 4 c/s.

621.396.67.029.64 : 621.315.61 **1343**

Dielectric Housings for Centimetre-Wave Antennae.—J. B. Birks. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 647–657.) Expressions are derived for the reflection and transmission coefficients of plane waves when incident normally or obliquely on two parallel semi-reflecting discontinuities. The design and performance of various dielectric housings (radomes) at 10 cm and 3 cm are discussed, with reference to the effect on aerial gain, impedance, polar diagram and polarization.

621.396.671.011.2 **1344**

Radiation Impedance and Aerial Shortening of the Transmitter-Dipole.—J. Müller-Strobel. (*Bull. schweiz. elektrotech. Ver.*, 1946, Vol. 37, No. 24, pp. 710–714. Reprint. In German, with French summary.) The theory of sustained oscillations is applied to a transmitting dipole aerial (*a*) neglecting and (*b*) taking account of aerial losses. Formulae suitable for practical calculations have previously been given (3527 of 1945 and 22 of January). These are applied to an aerial supported by a balloon and curves are given for the real and imaginary parts of the radiation impedance. Calculated results for aerial shortening, taking account of aerial losses, are in good agreement with experimental values.

621.396.671.029.64 : 621.317.34 **1345**

The Influence of Re-Radiation on Measurements of the Power Gain of an Aerial.—A. B. Pippard,

O. J. Burrell & E. E. Cromie. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 720–722.) A modification of Purcell's method is given, taking account of re-radiation which frequently introduces considerable errors. In the direct method of measuring power gain, re-radiation errors are practically negligible.

621.396.676 : 629.13 **1346**

Cavity Aircraft Antenna.—H. Kees & F. Gehres. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 78–79.) Description, with polar diagrams, of a small shunt-excited receiving quarter-wave aerial, fitted inside a cavity, and recessed into the body of an aircraft. The aerial shows good response when used for 75-Mc/s marker-beacon reception.

621.396.677 **1347**

Elimination of Errors from Crossed-Dipole Direction-Finding Systems.—R. A. Smith & C. Holt Smith. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 575–587.) The main sources of error in the early types of C.H.L. apparatus are discussed. The two most serious sources of error are the feeder and reflector systems. In later apparatus, aerials were designed to match the transmission lines, reflector systems to give adequate sense discrimination, reliable operation and minimum errors, and transmission systems to give maximum stability and energy transfer with minimum errors. Difficulties at the receiving end were overcome by the inclusion in each transmission system of a lattice-type phase-shifting network followed by an impedance matching unit. Very careful bonding of the transmission lines was found necessary. Installation and calibration procedures are outlined. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 59–60.

621.396.677 **1348**

Theoretical Treatment of Short Yagi Aerials.—W. Walkinshaw. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 598–614.) Design data are given for four arrays with driven half-wave dipoles and various arrangements of parasitic radiators. Polar diagrams, power gain and input resistance curves, as a function of the self-reactance of the radiators, are given for each array system.

621.396.677 **1349**

The Gain of an Idealized Yagi Array.—D. G. Reid. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 564–566.) An expression is derived for the power gain, compared with a doublet, of an end-fire array having an infinite number of infinitely closely spaced elements, the currents in successive elements being constant in amplitude but progressively and uniformly retarded in phase. Curves show the variation of gain with the overall length of the array for a number of values of phase velocity. The envelope of these curves enables the maximum gain for a given length of array and the corresponding value of the phase velocity to be found.

621.396.677 **1350**

Design of Directive Broad-Band Antennas.—R. Baum. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 956–959.) In the design of an aerial array the ideal polar diagram is usually determined on the assumption that mutual coupling between the various elements is negligible. The presence of mutual coupling causes a distortion of the polar diagram, the nulls being replaced by non-zero minima which may occur in wrong directions. The effects of mutual coupling may be largely compensated by the use of suitably disposed passive elements.

621.396.677 **1351**

On Some Problems of the Theory of Highly-Directive Antenna Arrays.—S. Tetelbaum. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 285–292.) The properties of broadside arrays of elementary dipoles excited in phase are considered for the case in which curvature of the wavefront is important; i.e., when the problem is concerned with the mutual coupling of a single dipole and a broadside array. It is shown that for a plane array, there is an optimum size for maximum transfer between dipole and array. Spherical broadside arrays, in which individual dipoles are centred on the surface of a sphere having the single dipole at its centre are also considered. In this case, a focusing of energy takes place and there are no optimum dimensions. Formulae for radiation resistance are given.

621.396.677 : 621.392.029.64 **1352**

The Design of a Wave-Guide-Fed Array of Slots to give a Specified Radiation Pattern.—A. L. Cullen & F. K. Goward. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 683–692.) A method of obtaining any specified aperture distribution from a waveguide-fed array of slots. The problem of obtaining a specified radiation pattern can then be solved by using the well-known Fourier transformation. Experimental results confirm the theory.

621.396.677 : 621.392.029.64 **1353**

A Wide-Band Linear Array Aerial.—L. H. Dawson & N. M. Rust. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 693–699.) This 10-cm array consists of half-wave dipole elements spaced $\lambda_G/4$ apart in a 3 inch × 1 inch waveguide, with alternate elements off-set from the centre line. With an 8-ft array the beam width is about 2.5° for half power in the horizontal plane, with the largest side lobe 1% of the main beam. When used with a cylindrical parabolic reflector, the array produces a beam width of about 7° in the vertical plane. The beam shape remains almost constant over a 10% frequency shift. The effects of mutual coupling, change of line length and of characteristic admittance in a feeder loaded by equal small admittances at quarter-wave spacing are discussed.

621.396.677.029.6 **1354**

New Parasitic Beam Design.—R. G. Rowe. (*Radio News*, Jan. 1947, Vol. 37, No. 1, pp. 40–41 . . 94.) Constructional details of a four-element, close-spaced aerial array for use on frequencies of 28 Mc/s and above, designed so that the length of each half-wave section can be very easily adjusted.

621.396.677.029.62 **1355**

Divided Broadside Aerials with Applications to 200-Mc/s Ground Radiolocation Systems.—D. Taylor & C. H. Westcott. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 588–597.) A general account of such aerial arrays and their characteristics, with particular reference to their use in C.H.L. and G.C.I. systems. Practical details of a mobile G.C.I. system are given and also of a fixed G.C.I. station, including a specially designed rotary capacitance switch capable of handling peak power up to 150 kW.

621.396.677.029.62 **1356**

Variable-Elevation Beam-Aerial Systems for $1\frac{1}{2}$ Metres.—G. E. Bacon. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 3, pp. 539–544.) A stack of nine banks of four dipoles each, mounted on a 120-ft tower, is used to produce a beam which is very narrow in the vertical direction but wide horizontally. A special phase-shifting device, located near the centre of the stack and inserted in the feed line from the transmitter, enables the beam elevation to be varied rapidly. Two such installations are described, the first giving a 3° beam and measuring elevation to an accuracy of about ± 0.3° from $1\frac{3}{4}°$ to 15° and the second a $1\frac{1}{2}°$ beam measuring from $\frac{3}{4}°$ to 15° with a maximum error of 0.15°. The beam elevation obtained in practice agreed sufficiently well with the theoretical position for elevation calibration to be unnecessary. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 52–53.

621.396.677.029.64 **1357**

A Detailed Experimental Study of the Factors influencing the Polar Diagram of a Dipole in a Parabolic Mirror.—E. G. Brewitt-Taylor. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 679–682.) Details are given of the effect on beam position of variations in wavelength, dipole length and position, length of balancing sheath on the coaxial transmission line, and parasitic reflector position. Results are also given for a dipole designed to give a 'skewed' beam without mechanical displacement.

621.396.677.029.64 **1358**

A Dielectric-Lens Aerial for Wide-Angle Beam Scanning.—F. G. Friedlander. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 658–662.) The design of an aplanatic dielectric lens suitable for an aerial system of the sectoral horn type is considered. For certain values of the refractive index a plano-convex lens can be found which can be regarded as aplanatic in practice. To avoid distortion when the beam is scanned through a large angle by moving the source, a ray from the focus must meet the corresponding final ray on a circle with centre at the focus and radius equal to the focal length.

621.396.677.029.64 : 621.392.029.64 **1359**

Directive Couplers in Wave Guides.—M. Surdin. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 725–736.) The directivity and attenuation is calculated by a method due to H. A. Bethe (706 of 1945) for systems such as two parallel or crossed waveguides, using circular holes or linear slots as coupling elements. Broad-band couplers are obtained by multiplication of these coupling elements. The importance of mechanical accuracy, perfect matching, and finite size of coupling elements is discussed.

621.396.677.029.64 : 621.392.029.64 **1360**

Resonant Slots.—W. H. Watson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 4, pp. 747–777.) The coupling of a resonant half-wave slot to a rectangular waveguide is discussed in relation to the feeding of microwave radiators. "The laws of guide coupling are explained in terms of the manner in which impedance is transferred from the position of the slot centre in guide 2 into guide 1 at the same position." The coupling of variable reactances to produce a T-section load is discussed. The waveguide feed for a microwave array is analysed with reference to the bandwidth of the system, and performance details are given of a broad-band array of inclined displaced slots. Radiation patterns are given for a 5% frequency change in the S-band.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.012.3 : 515.53 **1361**

The Application of Riemann's Number Sphere and Its Projections to A.C. Engineering.—F. Steiner. (*Radio Welt*, Oct. 1946, Vol. 1, No. 2, pp. 23–26.) Stereographic projection of the number sphere leads to a better representation of resistances than that using the Gauss plane; transfer from resistance to conductance merely requires a rotation through 180°. A parallel projection method is developed for obtaining the terminating resistance from measurements of the terminal voltages of two quadripoles in series.

621.314.223 : 621.392.5.012.8 **1362**

General Theory of the Autotransformer.—P. Thévenin. (*Radio en France*, 1947, No. 2, pp. 37–38.) The quadripole equivalent of an autotransformer is of T type and appropriate formulae are derived. The T scheme is found particularly suitable for determining short-circuit voltages.

621.316.726.078.3 : 621.396.62.029.64 **1363**

Crystal Control for Stability in V.H.F. Receivers.—N. L. Chalfin. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 71–73.) By using crystal harmonics, no-drift sets can be designed for cheap production.

621.318.572 **1364**

Modern Geiger-Muller Counters.—A. Graves. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 80–83.) A counting circuit providing an accurate mechanical counter for rates up to 600 per minute and a less accurate electronic integrator for higher counting rates. Various applications are mentioned.

621.319.4 : 621.793.14 **1365**

Metallized Capacitor Dielectrics.—J. I. Cornell. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 98..157.) A recently developed American product called the 'Solite' capacitor has aluminium electrodes deposited directly on to the paper dielectric by a vaporization process. These capacitors are very small in size, and have long life and a low power factor.

621.319.4.011.4 : 537.224 **1366**

Calculation of the Edge Correction for Capacitors.—Zickner. (*See* 1403.)

621.319.43 **1367**

A Note on Variable Capacitors.—M. Parodi & F. Raymond. (*Onde élect.*, Dec. 1946, Vol. 26, No. 237, pp. 477–478.) A formula is derived from which the shape of the moving plates can be calculated for a given capacitance law.

621.39.011 **1368**

Application of Complex Functions to Frequency-Transposition Systems.—F. H. Stieltjes. (*Tijdschr. ned. Radiogenoot.*, Nov. 1946, Vol. 11, No. 6, pp. 221–271. In Dutch with English summary.) Campbell's 'cisoidal oscillations' are used to develop a theory of these systems (i.e., modulators, etc.) which is analogous to normal circuit theory; equivalent circuit diagrams are given which show the behaviour of such systems at a glance. Practical applications are discussed.

621.39.012 **1369**

Functional Schematic Diagrams.—S. H. Larick. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 1005–1007.) Suggestions for clarifying schematic and circuit diagrams. Stress is laid on the importance of correctly representing the functions of circuits rather than the layout of components.

621.392.2 : 621.314.2 **1370**

Design of 500 kc/s Transformers.—R. Lee. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 84–86.) Description of the development of untuned, laminated, iron-cored transformers to cover the frequency range of 50 kc/s to 515 kc/s. Constructional technique is briefly indicated and performance curves are given.

621.392.5 **1371**

Generalization of the Conception of Rejector Filters.—F. Raymond. (*C. R. Acad. Sci., Paris*, 27th Dec. 1943, Vol. 217, No. 26, pp. 680–682.) A quadripole with connexions between its input and output terminals behaves as a rejector filter for the frequencies transmitted by the quadripole without damping or phase change.

621.392.52 : 519.27 **1372**

The Wiener RMS (Root Mean Square) Error Criterion in Filter Design and Prediction.—N. Levinson. (*J. Math. Phys.*, Jan. 1947, Vol. 25, No. 4, pp. 261–278.) Methods are given for determining quantitatively the extent to which message and noise can be separated and for the design of a filter to effect this separation. The problem of simultaneous filtering and predicting is considered. The r.m.s. approach used is an approximation to and a simplification of the transcendental case developed by N. Wiener.

621.394/.397].645 **1373**

Graphical Solutions for Cathode Followers.—H. L. Krauss. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 116–121.) Design data can be computed given only the conventional family of plate characteristics and the load, which is regarded as a pure resistance.

621.394.645.35 : 621.317.715 **1374**

Contact Modulated Amplifier.—Perkin-Elmer Corporation. (*See* 1512.)

621.396.611.1 : [531.33/.39 **1375**

On the Stability Conditions of Oscillating Systems.—Couffignal. (*See* 1497.)

621.396.611.3 **1376**

Propagation of Waves in Periodic Systems, taking Account of Certain Boundary Conditions.—P. Marié. (*C. R. Acad. Sci., Paris*, 29th April 1946, Vol. 222, No. 18, pp. 1039–1042.) An expression is derived, involving electrospherical polynomials of order $(n - 1)$, for the attenuation ratio of a series of $(n + 1)$ oscillatory circuits, loosely coupled by mutual inductance, under certain simplifying assumptions. See also 661 of March.

621.396.611.3.015.3 **1377**

Transient Regimes in Coupled Resonators.—P. Marié. (*C. R. Acad. Sci., Paris*, 6th May 1946, Vol. 222, No. 19, pp. 1096–1098.) Continuation of 1376 above. For the general case of n identical obstacles and where the condition for iterative reflection is satisfied, the intensity of the signal transmitted in the transient regime is represented by an integral Bessel function which can be expanded in a rapidly converging series of Bessel functions. This result is valid for a chain of feebly oscillating coupled circuits terminated by its iterative impedance.

621.396.611.4 **1378**

Principles aiding the Calculation of Electromagnetic Cavities.—J. Bernier. (*C. R. Acad. Sci., Paris*, 29th Nov. 1943, Vol 217, No. 22, pp. 530–532.) A continuation of 2155 of 1945. From the principle of similitude it follows that if all the geometric dimensions of a cavity are multiplied by m, the natural wavelengths, self-inductance, and capacitance will also be multiplied by m, while the parallel resistance is divided by $\sqrt{m}$ and the mutual inductance per square centimetre of the coupling loop by m. The principle of symmetry enables the modes of vibration of a cavity made up from one with a plane side and its mirror image in that plane side, to be deduced from those of the smaller cavity. The equivalence between two of Maxwell's equations and a principle of minimum energy analogous to the principle of least action, enables the natural frequencies and the fundamental fields of a cavity to be studied by the methods of the calculus of variations. In this way the variations in natural frequencies caused by small deformations of the cavity wall can be determined. The principle of orthogonal trajectories can also be applied.

621.396.611.4.029.64 **1379**

Resonance Cavities used for Ultra-Short Waves.—A. Briot. (*Télévis. franç.*, Dec. 1945, No. 8, pp. 7–10.) A mathematical treatment, based on Maxwell's equations, of the general case of cavity resonance, with application to the determination of the natural resonance frequencies of cylindrical cavities.

621.396.615 **1380**

Complete Theory of Valve Oscillators.—D. Guindin. (*Rev. sci., Paris*, Aug. 1946, Vol. 84, No. 3255, pp. 165–168.) The grid and anode currents are assumed to be sinusoidal. An approximate formula for the wavelength is derived mathematically, and agrees better with experimental results than that of classical theory which neglects the grid current.

621.396.615 **1381**

A Stabilized Modulated Oscillator.—A. E. Hayes, Jr. (*Radio News*, Jan. 1947, Vol. 37, No. 1, pp. 28–29.) Spurious frequency-modulation in an amplitude-modulated oscillator is eliminated by a secondary circuit producing frequency-modulation which is controlled and switched to oppose it.

621.396.615.14 **1382**
Ring Oscillators for U.H.F. Transmission.—Gootée. (*See* 1623.)

621.396.615.17 : 621.317.755 **1383**
New Timebase Circuit for Cathode-Ray Oscillographs.—(*Elektrotech. Z.*, 20th April 1944, Vol. 65, Nos. 15/16, pp. 138–139.) An auxiliary shunt circuit, with properly chosen time constant, enables the capacitor connected across the time-deflexion plates of the c.r.o. to be charged with sensibly uniform current. A modification of the arrangement gives a linear single sweep.

621.396.619.11/.13 **1384**
Theory of the Frequency Discriminator.—P. Güttinger. (*Bull. schweiz. elektrotech. Ver.*, 7th Sept. 1946, Vol. 37, No. 18, pp. 531–534. Reprint. In German, with French summary.) A general theory is developed. The conditions for linearity are considered from a new point of view. The main problem investigated is the demodulation of f.m. waves, with particular reference to the transformation of f.m. into a.m. with the least possible distortion.

621.396.619.23 **1385**
Overmodulation without Sideband Splatter.—Villard. (*See* 1625.)

621.396.645 : 621.43.019.8 **1386**
Constant-Gain Knock Pickup Amplifier.—Krebs & Dallas. (*See* 1551.)

621.396.662.3 **1387**
Introduction of the Idea of the Coupling Quadripole.—L. Boé. (*Radio en France*, 1947, No. 2, pp. 29–31.) A coupling quadripole is any quadripole with zero open-circuit impedance and infinite short-circuit impedance. It is the basis of nearly all the simplifications possible in systems of quadripoles of the general type.

621.396.662.3 **1388**
General Theory of Decimal Attenuators.—P. Thévenin. (*Radio en France*, 1947, No. 2, pp. 26–29.) The decimal attenuator consists of three quadripoles whose input and output terminals are connected in parallel, the quadripoles comprising three identical resistances R, three identical variable attenuators and respectively 0, 1 and 2 T-type lines of characteristic impedance R and reduction 1/10. Theory shows that such an attenuator, connected between a generator and a receiver, will give ratios between generator output voltage and receiver input voltage varying in steps of 1/1 000 of a value determined by the receiver impedance, from 1.110 to 0.001. Some applications are discussed.

621.396.69 **1389**
Components.—M. Chauvierre. (*Radio en France*, 1947, No. 2, pp. 4–7.) A general critical discussion of present design trends in various countries for valves, circuit components, tuning units and loudspeakers.

621.396.692.029.3 **1390**
Notes on the Construction of Attenuator Resistors.—F. Tournery. (*Radio en France*, 1947, No. 2, pp. 32–33.) Economical methods of construction for all audio frequencies are described.

621.396.694.011.3/.4 **1391**
Study of Electronic Reactance-Variation Devices.—W. Mazel. (*Toute la Radio*, Jan. 1947, Vol. 14, No. 112, pp. 34–38.) Reactance tube circuits are described whose behaviour for reactance-variation depends solely on a proper choice of the values of the resistors and capacitors involved. The operation of such circuits is explained with the aid of graphs and the results obtained with particular circuits are discussed.

GENERAL PHYSICS

53.081 **1392**
On Unities [units] **and Dimensions.**—H. B. Dorgelo & J. A. Schouten. (*Proc. Acad. Sci. Amst.*, Feb. & March 1946, Vol. 49, Nos. 2 & 3, pp. 123–131 & 282–291.) Discussion of the analogy between electric and magnetic quantities, of the relative merits of rationalized and unrationalized Giorgi units and of the expression of quantities dimensionally. Tables are given of units, dimensions and the field equations using the c.g.s., Gauss and Giorgi systems.

530.145.6 **1393**
Physical Interpretation of Wave Mechanics.—P. Destouches-Février & J. L. Destouches. (*C.R. Acad. Sci., Paris*, 6th May 1946, Vol. 222, No. 19, pp. 1087–1089.) A discussion of the basic principles of wave mechanics and of its relation to the quantum theory.

530.145.6 **1394**
On New Relations between the Densities of Mean Values in Dirac's Electron Theory.—G. Petiau. (*Rev. sci., Paris*, June/Dec. 1945, Vol. 83, Nos. 3245/3251, pp. 303–306.)

530.145.65 **1395**
An Interpretation of L. de Broglie's Equations for the Photon.—R. Murard. **Physical Interpretation of L. de Broglie's Equations for the Photon.**—R. Murard. (*C. R. Acad. Sci., Paris*, 29th April & 6th May 1946, Vol. 222, Nos. 18 & 19, pp. 1030–1032 & 1075–1076.) Relativistic theory of systems of particles shows that the photon can be considered as a system of two Dirac corpuscles whose relative motion round their common centre of gravity is evanescent. Regarding the photon as a Dirac corpuscle of positive energy combined with a lacuna in the series of states of negative energy, the relativistic wave mechanics of systems of particles completely justifies L. de Broglie's photon theory.

530.162 + [621.315.6 : 621.396.822 **1396**
The Response of Biased, Saturated Linear and Quadratic Rectifiers to Random Noise.—Middleton. (*See* 1565.)

534.321.9 : 621.315.58 **1397**
The Effect of Ultrasonic Waves on the Conductivity of Salt Solutions.—F. E. Fox, K. F. Herzfeld & G. D. Rock. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 329–339.) The conductivity is increased by an adiabatic compres-

sion because of direct pressure influence and temperature increase. Equipment is described for measurements between 200 kc/s and 1.5 Mc/s.

535.14 **1398**

The Photoelectric Effect.—C. Gutton. (*Télévis. franç.*, March 1946, No. 11, pp. 9–10.) A short historical account of the experimental laws which led Einstein to his corpuscular theory of light and thence to the development of wave mechanics by L. de Broglie.

535.343.4 + 621.317.011.5 + 621.396.11.029.64] : 546.171.1 **1399**

The Ammonia Spectrum and Line Shapes near 1.25 cm Wave-Length.—C. H. Townes. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 665–671.) Results are compared with those of Bleaney & Penrose (2622 of 1946) and of Good (3236 of 1946).

537.12/.13 **1400**

Fundamental Particles.—R. E. Peierls. (*Nature, Lond.*, 30th Nov. 1946, Vol. 158, No. 4022, pp. 773–775.) A descriptive account of current ideas concerning the nature and properties of the fundamental particles of physics, namely the electron, proton, photon, positron, neutron, neutrino, meson and negative proton.

537.12 **1401**

On the Self-Energy of the Electron.—G. Racah. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 406–409.) " Some evidence is given that the self-energy of an electron in the hole theory is finite, but coincides with mc^2 only if e^2/hc satisfies a particular equation."

537.122 **1402**

Determination of the Electronic Charge by the Oil-Drop Method.—V. D. Hopper. (*Nature, Lond.*, 30th Nov. 1946, Vol. 158, No. 4022, pp. 786–787.) Experiments are described which show that in the oil drop determination of e, the hole in the capacitor plates may distort the electric field appreciably and thus introduce an error. The magnitude of this error in previous measurements is discussed.

537.224 : 621.319.4.011.4 **1403**

Calculation of the Edge Correction for Capacitors.—G. Zickner. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 1–16.) An extension of classical work to a large number of specific conductor systems.

537.291 **1404**

On the Back Action [reaction] **of the Electromagnetic Field on a Moving Electron.**—M. Markov. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 159–166.)

537.291 **1405**

The Motion of Positive Ions in the Electric Field in a Gas.—L. Sena. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 179–182.) A relation between the velocity of drift of ions and the ratio of field strength to gas pressure is established on the assumption that charge exchange of the ions is the predominant process in the interaction between ions and atoms.

537.525.5 + 621.396.822] : 621.385 **1406**

Noise and Oscillations in Hot Cathode Arcs.—J. D. Cobine & C. J. Gallagher. (*J. Franklin Inst.*, Jan. 1947, Vol. 243, No. 1, pp. 41–54.) A summary was abstracted in 3266 of 1946.

537.525.6 **1407**

Energy Distribution of Electrons in High Frequency Gas Discharges.—T. Holstein. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 367–384.) An equation for the energy distribution is obtained and the limitations of its application are defined. Methods of solution and examples are given.

537.56 : 621.385 **1408**

Ionization Currents in Non-Uniform Electric Fields.—P. L. Morton. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 358–366.) A differential-difference equation for the electron current as a function of the electron energy and distance from the cathode end of a glow discharge is derived and the ionization currents are calculated by a step-by-step method.

538.24 **1409**

Magnets in Permeable Media and Definition of Magnetic Moment.—H. Diesselhorst. (*Elektrotech. Z.*, 6th April 1944, Vol. 65, Nos. 13/14, pp. 119–122.)

538.24 **1410**

Induced Magnetization and Magnetic Moments.—É. Brylinski. (*C. R. Acad. Sci., Paris*, 29th April 1946, Vol. 222, No. 18, pp. 1035–1037.) Consideration of the effects produced in a non-magnetic material, when a magnetic field is applied, shows that the moment of the couple exerted by a uniform field H on a plane closed current is the algebraic sum of the moment caused by the field H and of that due to the field $4\pi I$ which results from the reaction of the material, the magnetic moment remaining independent of the material. On the assumption that all magnetism is due to moving electric charges in vacuo, it is concluded that the volume integral definition of magnetic moment, which leads to a contradiction, should be abandoned.

538.3 : 517.9 **1411**

Applications of the Riesz Potential to the Theory of the Electromagnetic Field and the Meson Field.—N. E. Fremberg. (*Proc. roy. Soc. A*, 31st Dec. 1946, Vol. 188, No. 1012, pp. 18–31.) Riesz's method " yields simple deductions of classical results . . [and] also the results recently obtained by Dirac regarding the proper energy and proper momentum of an electron." Bhabha's analogous theory of the neutral meson field is also treated.

538.32 **1412**

The Distribution of Currents induced by a Plane Wave on the Surface of a Conductor.—V. Fock. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 130–136.) If λ is small compared with the dimensions and radii of curvature of the conductor, the current distribution near the geometrical shadow can be expressed in terms of an universal function, which is tabulated.

538.566 **1413**

The Propagation of Electromagnetic Waves in Two or More Successive Media and the Diffraction of These Waves Referred to the Study of Cauchy's Problems.—L. Robin. (*Rev. sci., Paris*, Jan/May 1946, Vol. 84, Nos. 3252/3253, pp. 7–14.) A mathematical paper. Earlier work of Delsarte (*Ann. sci. Éc. norm. supér.*, 1936, Vol. 53, pp. 223–273) is confirmed and extended to the case of two homogeneous isotropic media, of given dielectric constant, permeability, and electrical conductivity, separated by a plane interface.

In general the dielectric constants and the permeabilities alone determine whether Maxwell's equations for this problem have a unique solution or no solution ; the conductivities are only involved in certain limiting cases.

539.234 + 621.793.14 **1414**

Phenomena of the Production of Thin Metallic Layers by Vaporization.—H. Stahl & S. Wagener. (*Z. tech. Phys.*, 1943, Vol. 24, Nos. 10/12, pp. 280–287.)

53 **1415**

Reports on Progress in Physics, Vol. X (1944–45). [Book Review]—W. B. Mann (Ed.). Physical Society, London, 442 pp., 30s. (*J. sci. Instrum.*, Dec. 1946, Vol. 23, No. 12, p. 302.) A list of subjects and authors is given.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523 : 621.396.822.029.6 **1416**

Disturbances of Extraterrestrial Origin in the Short Wave Band.—Steinberg & Denisse. (*See* 1575.)

523.5 : 621.396.812 **1417**

On the Detection of Meteors by Radio.—L. A. Manning, R. A. Helliwell, O. G. Villard, Jr., & W. E. Evans, Jr. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 767–768.) Observations were made during the meteor shower of 9th Oct. 1946, using a 15-Mc/s, 100-kW broadcasting transmitter and also a 29-Mc/s c.w. transmitter of 0.7 kW. Signal strength bursts and Döppler whistles were observed on both frequencies and the results indicate that both bursts and whistles may be regarded as evidence of the passage of meteors. The use of c.w. unmodulated transmissions of relatively low power, with frequency about 30 Mc/s, has definite advantages for meteor observation.

523.74 : 621.396.821 **1418**

Radio Effects observed during the Period of Solar Activity from 31st Jan. to 14th Feb. 1946.—Bureau. (*See* 1564.)

523.746 **1419**

On Movements and Origin of Sunspots.—J. Tuominen. (*Observatory*, Dec. 1946, Vol. 66, No. 835, pp. 387–391.)

523.746 : 551.510.535 : 621.396.11 **1420**

Effect of Sunspot Cycles on Long Distance Radio Signals.—H. T. Stetson. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 44–49.) A survey of sunspot activity and critical frequencies over the period 1934–1946. Absorption in the E layer is an important factor in the prediction of usable frequencies.

523.77 **1421**

Solar Ultraviolet Spectrum to 88 Kilometers [above the earth].—W. A. Baum, F. S. Johnson, J. J. Oberly, C. C. Rockwood, C. V. Strain & R. Tousey. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 781–782.) The spectrum below 3 400 Å was photographed by means of a grating spectrograph mounted in the tail fin of a V-2 rocket. The results show a progressive extension of the spectrum into the ultraviolet with increasing height. Detailed analysis of the results is in progress.

523.854 **1422**

The Magnetic Field of the Galaxy.—L. Spitzer, Jr. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 777–778.)

537.591 + 523.165 **1423**

An Investigation of the Absorption of Cosmic Rays in a Strong Magnetic Field at 3 250 m above Sea Level.—A. Alichanian, A. Alichanow, S. Nikitin & A. Weissenberg. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 294–295.) Continuation of work described in 73 of 1946 (Alichanow & Alichanian). Results indicate that a proportion of the soft component is not composed of electrons ; it is suggested that the particles observed may be protons.

537.591 **1424**

Cosmic-Ray Effects at High Altitudes.—C. D. Anderson. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, p. 788.) Summary of Amer. Phys. Soc. paper.

537.591 **1425**

Recent Cloud-Chamber Observations of the Soft Component of Cosmic Rays.—W. Hazen. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, p. 789.) Summary of Amer. Phys. Soc. paper.

537.591 **1426**

The Energy Spectrum of Cascade Electrons.—I. Tamm & S. Belenky. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 660–664.)

537.591 **1427**

The Multiple Production of Neutrons by Cosmic Radiation.—S. A. Korff & B. Hamermesh. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 429.)

537.591 **1428**

The Mass of the Mesotron as determined by Cosmic-Ray Measurements.—D. J. Hughes. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, p. 791.) A review of published results leads to the conclusion " that the spread in mass values exceeds the experimental errors, and that it is extremely likely the mesotron does not possess a unique mass." But see 1429 below. Summary of Amer. Phys. Soc. paper.

537.591 **1429**

The Mass of Cosmic-Ray Mesotrons.—W. B. Fretter. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 625–632.) The range of mesotrons in lead as a function of their momentum was determined by a double cloud-chamber method. The results are consistent with a unique rest mass for mesotrons of 202 times that of an electron. But see 1428 above.

537.591 **1430**

Mass of Cosmic-Ray Mesotrons.—W. B. Fretter & R. B. Brode. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, p. 791.) Summary of Amer. Phys. Soc. paper.

537.591 **1431**

Measurement of Meson Masses by the Method of Elastic Collision. Probable Existence of a Heavy Meson (1000 m_0) in the Cosmic Radiation.—L. Leprince-Ringuet. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 791–792.) Summary of Amer. Phys. Soc. paper.

537.591 **1432**

Some Problems in the Study of Cosmic-Ray Mesons.—B. Rossi. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, p. 788.) Summary of Amer. Phys. Soc. paper.

537.591 **1433**

Origin of Cosmic-Ray Mesons.—M. Schein. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 788–789.) Summary of Amer. Phys. Soc. paper.

537.591 **1434**

On the Determination of the Energy Spectrum and Sign of Primary Cosmic Radiation.—M. S. Vallarta, M. L. Perusquía & J. De Oyarzabal. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 785–786.) Summary of Amer. Phys. Soc. paper.

537.591 **1435**

On the Space Correlation of Particles in Cosmic Rays: Part 2—Correlation between Electrons and Photons.—V. Berestetzky. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 211–216.)

537.591 **1436**

Ionizing Power of Particles of the Hard and Soft Components of the Cosmic Radiation.—N. Dobrotin. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 207–210.)

537.591 **1437**

Attempt of an Analysis of Some Cosmic-Ray Phenomena.—R. P. Feynman & H. A. Bethe. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 786–787.) Summary of Amer. Phys. Soc. paper.

537.591 : 523.7 **1438**

Three Unusual Cosmic-Ray Increases possibly due to Charged Particles from the Sun.—S. E. Forbush. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 771–772.)

537.591.15 **1439**

Atmospheric Showers and Bursts.—D. Skobeltzyn. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 441–442.)

537.591.15 **1440**

Penetrating (Atmospheric) Showers in Cosmic Rays.—V. Veksler, L. Groshev & L. Lazareva. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 440–441.)

537.591.15 **1441**

Penetrating Cosmic Ray Showers at 3 860 m above Sea Level.—L. Bell, N. Birger & V. Veksler. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 198–199.) Results of observations on the Pamir plateau.

537.591.15 : 539.16.08 **1442**

A Cloud-Chamber Investigation of Penetrating Showers.—G. D. Rochester. (*Proc. roy. Soc. A*, 13th Dec. 1946, Vol. 187, No. 1011, pp. 464–479.) "Some 20% of penetrating showers are accompanied . . . by what appear to be electron cascades. . . . These showers may be due to electrons or photons produced in processes which become important at very high energies; e.g., $>10^{11}$eV."

537.591.5 **1443**

Composition of Cosmic Rays at a Height of 3 250 m above Sea Level.—A. I. Alikhanoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, No. 3, pp. 135–144. In Russian.)

550.38 **1444**

On the Question of the Origin of Terrestrial Magnetism.—Y. P. Bulashevich. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géoph.*, 1944, Vol. 8, Nos. 2/3, pp. 93–95. In Russian.)

551.510.535 **1445**

Sporadic E-Region Ionization at Watheroo Magnetic Observatory 1938–1944.—H. W. Wells. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 950–955.) Continuous recordings of the occurrence of the sporadic E_1 layer have been analysed to determine diurnal, seasonal, annual or other regular variations. It is inferred that there is no direct relationship with recurrent solar phenomena or with magnetic disturbances.

551.510.535 **1446**

The Mechanism of Ionospheric Ionization: Part 2.—R. v. d. R. Woolley. (*Proc. roy. Soc. A*, 13th Dec. 1946, Vol. 187, No. 1011, pp. 403–415.) "The available mechanisms for the production of electrons in the three regions of the ionosphere are discussed with special reference to the question whether it is possible to account for the observed electron densities without supposing that the sun emits far more energy in the remote ultra-violet spectrum than would be emitted by a black body at 6 000°. The contributions to electron densities made by metastable states of atoms and molecules are examined. It is concluded that the observed electron densities may be accounted for without requiring high solar energy in the ultra-violet if the effective recombination coefficient in the F_2 region is 10^{-11}. The F_2 region is supposed formed by the ionization of atomic oxygen, and the E region by the ionization of molecular oxygen. The electrons forming the F_1 region are supposed to be provided by metastable N_2 or by NO." For part 1 see 416 of February.

551.510.535 : 621.396.11 **1447**

The Role of the Ionosphere in the Propagation of Radio Waves.—R. Jouaust. (*Bull. Soc. franç. Élect.*, June/July 1946, Vol. 6, No. 60, pp. 348–354.) A survey of present knowledge. Regular daily observations on the ionosphere have been carried out at the National Radio Laboratory, Bagneux, since April 1946. The programme envisaged is the extension of the observations to all the hours of the day and night and the progressive provision of further recording stations in France overseas.

551.594 **1448**

A New Theory of Atmospheric Electricity.—D. S. Kothari & L. S. Lothari. (*Sci. Culture*, Dec. 1946, Vol. 12, No. 6, pp. 261–263.) A discussion of Frenkel's theory (2186 of 1946) showing that it offers a qualitative explanation of some puzzling phenomena. It may have wider application to dust storms and the electrification of powders injected into gases.

551.594 : 551.574 **1449**
Influence of Water Drops on the Ionization and Electrification of Air.—J. Frenkel. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 151–158.)

614.825 : 551.594.221 **1450**
The Image of Objects produced by Lightning and Impulse Discharge in Atmosphere.—G. Spiwak & J. Kardash. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 252–256.) Laboratory reproduction of the imprinting by lightning of images of nearby objects on struck bodies.

LOCATION AND AIDS TO NAVIGATION

621.396.677 **1451**
Various Papers on Directive Aerials.—See Aerials section for papers prepared for the I.E.E. Radiolocation Convention, 1946.

621.396.9 : 623.454.25 **1452**
Radio Proximity-Fuze Development.—Hinman & Brunetti. (*See* 1555.)

621.396.932 **1453**
Radar Specifications for the Merchant Navy.—(*Onde élect.*, Dec. 1946, Vol. 26, No. 237, pp. 481–487.) The specifications for navigational radar issued by the Service des Phares français and by the London conference on radar navigational aids, May and June 1946, are given, and also that of the London conference for anti-collision radar.

621.396.932.078 + 621.396.664 **1454**
Radio Controlled Buoys.—A. F. Hopkins, Jr., & F. A. B. Smith. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 84–86.) A simple v.h.f. remote control selective relay system, originally used for rapid black-out of unattended buoys. Its application is being extended to foghorns and similar navigational aids only required occasionally.

621.396.933 : 621.38.001.8 **1455**
Analyzing Present Position of Electronic Aids for Airplanes.—G. Shea. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 34–41 . . 138.) A discussion of the many "problems encountered in flight together with recommended electronic solutions which have been offered the PICAO delegates". See also 112 of January and 428 of February.

621.396.96 **1456**
Identification, Friend or Foe — Radar's Sixth Sense.—L. E. Stuart. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 60–67.) Technical details of the U.S. Navy's auxiliary system of pulsed transmission and reception for the positive identification of aircraft.

621.396.96 **1457**
Low-Altitude Radar Bombsight.—J. W. Rieke. (*Bell Lab. Rec.*, Jan. 1947, Vol. 25, No. 1, pp. 13–16.) An account of the AN/APQ-5 equipment and its operation.

621.396.96 : 518.5 **1458**
The Ballistic Computer.—Juley. (*See* 1494.)

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 : 535.61-15 **1459**
Decay in Brightness of Infra-Red Sensitive Phosphors.—R. T. Ellickson & W. L. Parker. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 290–299.)

538.221.029.64 **1460**
Theory of the Dispersion of Magnetic Permeability in Ferromagnetic Materials at Microwave Frequencies.—C. Kittel. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 281–290.) An explanation of the experimental facts is proposed, based on a consideration of the equations of motion of a domain boundary in a applied magnetic field for frequencies such that the skin depth of the magnetic field is smaller than the thickness of the domain. A criticism is given of theories of ferromagnetic resonance.

546.287 **1461**
Silicone Oils — Part 2 : Their Applications.—D. F. Wilcock. (*Gen. elect. Rev.*, Dec. 1946, Vol. 49, No. 12, pp. 28–33.) For part 1 see 750 of March.

546.46.78 : 548.2 **1462**
The Crystal Structure of Magnesium Tungstate.—N. J. Dunning & H. D. Megaw. (*Trans. Faraday Soc.*, Dec. 1946, Vol. 42, No. 292, pp. 705–709.)

549.514.51 : 548.24 **1463**
Artificial Electrical Twinning in Quartz Crystals.—J. J. Vormer. (*Tijdschr. ned. Radiogenoot.*, Nov. 1946, Vol. 11, No. 6, pp. 215–219. In Dutch with English summary.) Electrical twinning can easily be produced below 573°C at well-defined places in AT-, CT- and GT-cut quartz plates. Such twinning may occur at points where leads have been soldered to the metal coatings. In some cases this type of twinning can be corrected by suitable heat treatment, but attempts to correct natural electrically-twinned quartz met with little success.

620.193.21 : 669.721 **1464**
Magnesium : Corrosion Resistance under Accelerated Atmospheric Conditions.—R. R. Rogers, D. A. Tetu & H. Livingstone. (*Metal Ind., Lond.*, 3rd Jan. 1947, Vol. 70, No. 1, pp. 9–10.) Magnesium and its alloys offer good resistance to corrosion except in marine atmospheres, in which case protective coatings of paints are desirable.

621.3.032.53 : 533.5 **1465**
Glass-to-Metal Seals.—G. D. Redston & J. E. Stanworth. (*J. Soc. Glass Tech.*, April 1945, Vol. 29, No. 132, pp. 48–76.) Stress-optical bench photoelastic measurements on standard sandwich seals over a wide temperature range are discussed. Axial stresses for bead seals at room temperature were determined by the method of Hull and Burger.

621.3.032.53 : 533.5 **1466**
Glass-to-Metal Seals, with Particular Reference to Current Lead-In Seals in Vacuum Devices.—R. W. Douglas. (*J. Soc. Glass Tech.*, April 1945, Vol. 29, No. 132, pp. 92–110.) A procedure for avoiding extreme stresses in manufacture or operation is described.

621.3.032.53 : 533.5 **1467**
Sealing Glasses.—A. E. Dale & J. E. Stanworth. (*J. Soc. Glass Tech.*, April 1945, Vol. 29, No. 132,

pp. 77–91.) A general discussion of the physical properties and chemical compositions of common sealing glasses and their applications. A method of classification is suggested.

621.314.63 **1468**

Remarks on the Operation and Construction of Barrier Layer Rectifiers.—M. Leblanc. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1946, Vol. 6, No. 61, pp. 444–452.) Discussion of various theories proposed to explain the differing properties of metals, semiconductors and insulators, with particular reference to conductivity. It is concluded that a dry rectifier consists of two crystalline lattices in which the concentration of the electrons is very different, separated by an insulating layer having a thickness of the order of a hundred atomic layers. Electrons crossing this layer obey the laws of wave mechanics. In metals, the free electrons do not obey the classical statistical laws because of their small mass; they form a degenerate gas to which the Sommerfeld-Fermi theory applies. In semiconductors the concentration of free electrons is so low that the electronic gas ceases to be degenerate and classical laws apply. Copper oxide, copper sulphide, and selenium rectifiers are discussed with special reference to the nature and mechanism of the dielectric separating layer.

621.314.63 **1469**

Applications of Dry Rectifiers.—J. M. Girard. (*Bull. Soc. franç. Élect.*, Oct. 1946, Vol. 6, No. 62, pp. 522–556.) The principles involved in rectifiers of the barrier-layer type are discussed and an account is given of the characteristics of selenium and copper-oxide rectifiers and of their commercial production. Many widely differing applications are described, ranging from apparatus giving many tens of thousands of amperes at low voltage to apparatus giving hundreds of thousands of volts at low currents of the order of tens of milliamperes.

621.315.22 : 669.715 **1470**

Cable Sheathing in Aluminium.—(*Light Metals*, Sept. 1946, Vol. 9, No. 104, pp. 474–498.) A critical survey of the possibility of replacing lead by aluminium, based on published German work. See also 1471 below.

621.315.22 : 669.715 **1471**

Insulated Cables and Wire in Aluminium.—(*Light Metals*, Dec. 1946, Vol. 9, No. 107, pp. 648–684.) A continuation of 1470 above. A survey of practice in various countries including France and Italy; the possibility of replacing copper by aluminium is considered with particular reference to the methods of cable joining.

621.315.61 : 537.228.1 **1472**

The Dielectric Properties of Ferroelectric (Seignette electric) Crystals and Barium Titanate.—V. Ginsburg. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 107–115.) A discussion based on thermodynamical consideration of a phase transition from a non-pyroelectric to a pyroelectric crystal.

621.315.61 : 546.4 **1473**

High Dielectric Constant Materials.—B. Wul [B. M. Vul]. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 95–106.) Another account in English of the experimental work noted in 3639 of 1946.

621.315.61 : 547 **1474**

Contribution to the Knowledge of Electrotechnical Organic Insulating Materials.—H. Stäger, B. Frischmuth & F. Held. (*Schweiz. Arch. angew. Wiss. Tech.*, Dec. 1946, Vol. 12, No. 12, pp. 372–390.) Research on the relation between the molecular structure of resinous substances, and the dielectric losses in layered insulating materials is described. The dielectric losses in such materials can be reduced by esterization of the cellulose hydroxyl substances used as binders; this also alters the mechanical properties of the materials. The losses in materials using glass as binder are dependent on the alkali content of the glass. With alkali-free glass the losses are considerably lower than with a cellulose-type binder and the mechanical properties are improved.

621.315.61 : 621.396.67.029.64 **1475**

Dielectric Housings for Centimetre-Wave Antennae.—Birks. (*See* 1343.)

621.315.611.011.5 + 537.226.3 **1476**

The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Solid Dielectrics: Part 2.—M. Gevers. (*Philips Res. Rep.*, Aug. 1946, Vol. 1, No. 4, pp. 279–313.) A review of available data, given by various authors. The data differ so widely that a relation between the power factor and temperature coefficient cannot be deduced. For part 1 see 125 of January.

621.317.333.8 : 621.392.015.33 **1477**

Insulation for High-Voltage Pulse Networks.—C. D. Owens. (*Bell Lab. Rec.*, Jan. 1947, Vol. 25, No. 1, pp. 28–31.) Breakdown tests on various materials, with point-to-point and point-to-plate electrodes, show correlation between arc resistance properties and ability to withstand high pulse voltages. Mica and glass-bonded mica were found best for arc resistance.

621.357.6 **1478**

Electroforming: Parts 1-3.—E. A. Ollard. (*Metal Ind., Lond.*, 3rd, 17th & 31st Jan. 1947, Vol. 70, Nos. 1, 3 & 5, pp. 6–8, 51–53 & 86–88.) A survey of moulds and moulding materials, conducting surfaces, types of metal, solution formulae, etc., for piece part production by electrodeposition. To be continued.

621.775.7 **1479**

Metallurgy of Powders; Study of Compressed Kovar.—Nguyen Thienchi. (*C. R. Acad. Sci., Paris*, 29th April 1946, Vol. 222, No. 18, pp. 1046–1047.) Kovar ingots were prepared from carefully purified Co, Ni and Fe, with no Mn. Rings from these ingots welded perfectly to a glass having an expansion coefficient of 5×10^{-6}. X-ray photographs show that in the case of the ingot obtained by h.f. heating, the alloy is well formed, with the same crystalline structure as kovar of American origin. The structure of that obtained by heating to 1 050°C for 10 hours is less definite, the diffraction lines being appreciably more diffuse.

621.793 : 666 **1480**

Metallizing Glass and Ceramic Materials.—A. J. Monack. (*Glass Ind.*, Jan. 1947, Vol. 28, No. 1, pp. 21–25 . . 44.) A detailed account of metallizing methods using (*a*) mechanical films, (*b*) metallic paints, (*c*) metal spraying, (*d*) cathode sputtering or evaporation in vacuo, (*e*) chemical reduction.

621.793.14 + 539.234 **1481**

Phenomena of the Production of Thin Metallic Layers by Vaporization.—Stahl & Wagener. (*See* 1414.)

669.018 : 621.775.7 **1482**

Fernico from Metal Powders.—E. E. Burger. (*Gen. elect. Rev.*, Dec. 1946, Vol. 49, No. 12, pp. 22–24.) Fernico, an alloy of Fe, Ni and Co, is produced from powdered materials by sintering. Its thermal expansion coefficient is almost the same as that of Corning glass 705AO, permitting seals to be made of almost any size or shape. Its electrical resistance is about $43\ \mu\Omega/\text{cm}^3$.

669-167 **1483**

The Structure and Appearance of Metal Surfaces.—J. H. Nelson. (*Metal Treatm.*, Winter 1946/1947, Vol. 13, No. 48, pp. 279–285.)

669.3 + 669.35 **1484**

Copper and Copper Alloys : a Survey of Technical Progress during 1946.—E. Voce. (*Metallurgia, Manchr*, Dec. 1946, Vol. 35, No. 206, pp. 78–84.) Discusses the production of copper, its up-grading by distillation, the casting and properties of various alloys, corrosion and oxidation and some aspects of physical metallurgy.

669.738 : 620.193.15 **1485**

Comparison of Electroplated Finishes under Humidity (K 110) Test.—(*Metallurgia, Manchr*, Dec. 1946, Vol. 35, No. 206, pp. 63–64.) Illustrations of results obtained by F. Taylor in work on cadmium plating described in 779 of March.

678.1.02 **1486**

Colloidal Carbon.—W. H. Cadman. (*J. R. Soc. Arts*, 27th Sept. 1946, Vol. 94, No. 4727, pp. 646–663.) A description of the methods of manufacture and the properties of carbon-black, with special reference to its use in the rubber industry.

679.5 **1487**

Polythene.—F. A. Freeth. (*Engineering, Lond.*, 25th Oct. 1946, Vol. 162, No. 4215, pp. 388–389.) Abridged English text of a lecture delivered at the 20th Congress of the Société de Chimie Industrielle.

679.5 **1488**

Contribution to the Knowledge of the Softening of Polyvinyl Chloride.—H. Stäger & F. Held. (*Schweiz. Arch. angew. Wiss. Tech.*, Sept. 1946, Vol. 12, No. 9, pp. 278–288.)

679.5 : 620.193.21 **1489**

The Behaviour of Thermosetting Plastics exposed to the Weather.—G. O. Grimm. (*Schweiz. Arch. angew. Wiss. Tech.*, Oct. 1946, Vol. 12, No. 10, pp. 311–322.) An account of tests, lasting over two years, on rods subjected to bending loads and on a wide range of mouldings exposed in the open. The materials were chiefly of the phenol and urea types, with various fillers. Short tests and weathering tests, with or without mechanical loading, do not give comparable results. Deterioration of materials exposed to the weather is greatly increased by simultaneous mechanical loading.

MATHEMATICS

51 : [5 + 6 **1490**

Advanced Instruction in Practical Mathematics.—A. Erdélyi & J. Todd. (*Nature, Lond.*, 16th Nov. 1946, Vol. 158, No. 4020, pp. 690–692.) A discussion of proposals for the foundation of an Institute for Practical Mathematics, with suggestions regarding staff and the functions of such an institution. These should include instruction in advanced mathematical techniques not usually included in university curricula, the provision of short courses for engineers and others and of post-graduate courses for mathematicians, the promotion of research and the preparation of monographs. See also leader in same issue, pp. 683–684, *Nature, Lond.*, 4th May 1946, Vol. 157, No. 3992, pp. 571–573, and *Nature, Lond.*, 21st Dec. 1946, Vol. 158, No. 4025, pp. 916–917.

512.831 : 621.392.1 **1491**

Matrix Methods in Transmission-Line and Impedance Calculations.—Watson. (*See* 1329.)

517.65 **1492**

The Finite Parts of Integrals and the Laplace-Carson Transformation.—J. Gilly. (*Rev. sci., Paris*, June/Dec. 1945, Vol. 83, Nos. 3245/3251, pp. 259–270.)

518.5 **1493**

Calculations and Electronics.—(*Electrician*, 8th Nov. 1946, Vol. 137, No. 3571, pp. 1279–1280.) A short account of the various features to be incorporated in the A.C.E. (automatic computing engine) designed by the National Physical Laboratory.

518.5 : 621.396.96 **1494**

The Ballistic Computer.—J. Juley. (*Bell Lab. Rec.*, Jan. 1947, Vol. 25, No. 1, pp. 5–9.) For A.A. fire control.

518.6 : 621.317.329 : 621.385 **1495**

Electrostatic Field Plotting.—Balachowsky. (*Bull. Soc. franç. Élect.*, April 1946, Vol. 6, No. 58, pp. 181–186.) Starting from one electrode, a second equipotential surface is plotted very close to the electrode. Laplace's equation is then used to calculate successive equipotentials until the neighbourhood of the second electrode is reached. The shape of this electrode can thus be found for any assigned value of its potential. Practical difficulties of the method are discussed. Similar graphical integration methods may be applied to problems involving the telegraphy equation.

519.28 : 52/59 **1496**

Choice of a ' Reality Index ' for Suspected Cyclic Variations.—W. Gleissberg. (*Nature, Lond.*, 21st Dec. 1946, Vol. 158, No. 4025, pp. 915–916.) A discussion of the cyclic variations apparent in some natural phenomena which are not purely periodic in nature. A ' reality index ' to indicate the degree of reality of such variations is defined and its use is demonstrated by an example taken from sunspot observations.

531.33/.39 : 621.396.611.1 **1497**

On the Stability Conditions of Oscillating Systems.—L. Couffignal. (*Rev. sci., Paris*, May 1945, Vol. 83 No. 3244, pp. 195–210.)

MEASUREMENTS AND TEST GEAR

620.199 : 621.315.614.6 **1498**

High-Speed Life Test for Capacitor Paper.—H. A. Sauer. (*Bell Lab. Rec.*, Jan. 1947, Vol. 25, No. 1, pp. 17–19.)

621.317.083.71 **1499**

Remote Indication of Measured Quantities using a Resistance Element and a Crossed-Coil Indicator.—J. Lorenz. (*Arch. tech. Messen*, Oct. & Nov. 1940, Nos. 112 & 113, pp. T109–110 & T121–122.)

621.317.323.027.21 **1500**

Measurement of H.F. Voltages of the Order of a Microvolt.—P. Mourmant. (*Radio en France*, 1947, No. 2, pp. 15–19.) Indirect methods are preferred. Practical difficulties and methods of standardization, and the stability of the heterodyne and measurement receivers are discussed.

621.317.33 : 621.385.3.032.2 **1501**

Inter-Electrode Capacitances of Triode Valves and Their Dependence on the Operating Condition.—S. C. Mitra & S. R. Khastgir. (*Indian J. Phys.*, June 1946, Vol. 20, No. 3, pp. 81–99.) Inter-electrode capacitances are measured by a double-beat method and their variation with filament and anode current for three different anode voltages with no grid bias are studied. Results for eight commercial valves are given and discussed.

621.317.336 : 621.396.67 **1502**

The Measured Impedance of Cylindrical Dipoles.—King. (*See* 1338.)

621.317.336.6 : 621.392.029.64 **1503**

Standing Wave Meter.—H. E. Kallmann. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 96–99.) A detailed description of an automatic standing wave detector of moderate accuracy designed for quick adjustments of microwave equipment. Power from a constant source is injected into a U-shaped waveguide. Power reflections caused by mismatch are measured automatically by a device which gives a direct meter indication of standing-wave ratio.

621.317.35 **1504**

The Cinematic Analyzer.—E. Aisberg. (*Radio Craft*, Dec. 1946, Vol. 18, No. 3, pp. 18–19..66.) This frequency analyser comprises a receiver and mixer, a wide band-pass amplifier tuned to 460 kc/s, a converter stage, an oscillator tuned to 877 kc/s and frequency-modulated over ± 50 kc/s by a vibrating reed wobbler, and a selective amplifier tuned to 417 kc/s. The output from the latter is applied to the vertical deflexion plates of a c.r.o., the 60 c/s sweep being synchronized with the supply to the wobbler. Applied frequencies between 410 and 510 kc/s thus appear as peaks on the screen, the height of the peaks indicating the signal amplitude. In addition to this direct application to i.f. stages, the apparatus can also be used for the study of receiver r.f. stages, selectivity curves and a.f. stages.

621.317.35 **1505**

Wave and Pulse Counter.—R. Blitzer. (*Radio Craft*, Dec. 1946, Vol. 18, No. 3, pp. 25, 49.) The incoming wave is amplified, clipped and reduced to sharp pulses, which are applied to the grid of a thyratron.

621.317.372.029.64 **1506**

Apparatus for Measurement of Centimetre Waves : Q-Meter and Wattmeter.—A. G. Clavier & R. Cabessa. (*Onde élect.*, Nov. 1946, Vol. 26, No. 236, pp. 421–429.) In the Q-meter a positive-grid valve, with anode voltage varied periodically (e.g., at 210 c/s), is used to create a variable electromagnetic field ; this in turn excites the resonant cavity, the Q of which is to be measured. A crystal detector is used to measure the field in the resonant cavity, the detector current being applied after amplification to the vertical plates of a c.r.o. ; the horizontal sweep is derived from the voltage used for modulation. The resonance curve thus obtained enables Q to be found. $Q = F_0/\Delta F$, where F_0 is the mean frequency, corresponding to the peak of the resonance curve, and ΔF is the width of the curve where the amplitude is half the maximum. A double-beat method can also be used. The apparatus described enables measurements of Q to be made from 2 000 to about 50 000 with an accuracy of the order of 10%. It has been used for measuring, at λ 8 cm, the attenuation constants of coaxial cables or of circular guides with E_{01} or H_{11} waves. The wattmeter comprises (*a*) a measurement line of characteristic impedance 90 Ω and of adjustable length, which is inserted between the u.h.f. source and the apparatus to be measured ; (*b*) a bolometer probe carried on a slider movable along the measurement line and (*c*) rack-mounted measurement equipment. The length of the line and the position of the bolometer are adjusted to obtain a system of stationary waves, the bolometer being at a current loop. Powers from 50 mW to 150 W can be measured with the apparatus on wavelengths between 8 and 14 cm with an accuracy of about ± 15%.

621.317.38 **1507**

Definitions and Measurement of Apparent Power and Energy.—A. Iliovici. (*Bull. Soc. franç. Élect.*, Dec. 1945, Vol. 5, No. 54, pp. 367–377.) Applicable to polyphase circuits.

621.317.7 **1508**

Manufacture of Electrical Measuring Instruments in India.—B. B. Bhowmik. (*Sci. Culture*, Dec. 1946, Vol. 12, No. 6, pp. 275–279.) A brief historical survey, with suggestions for future developments in the production of jewelled bearings, hair springs, pivots, magnets, etc.

621.317.7 : 621.385 **1509**

Portable Precision Valve Tester.—F. Haas. (*Toute la Radio*, Jan. 1947, Vol. 14, No. 112, pp. 59–61.) A description, with circuit diagrams and constructional details, of an instrument for measuring valve slope, cathode insulation, emission, and for testing filament continuity and insulation between electrodes.

621.317.7.082.78 **1510**

Electronic Magnetometer.—J. H. Rubenstein. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 156–164.) Compact, with sensitive pickup head. Suitable for remote indication of the change of position of a small permanent magnet attached to any moving object.

621.317.7.082.78.085.31 **1511**

Electronic Position Pickup.—D. W. Moore, Jr. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 100–101.)

An earth-inductor compass formed by mounting an armature on a piezoelectric crystal. A small permanent magnet is mounted on the pointer whose position is to be transmitted.

621.317.715 : 621.394.645.35 **1512**

Contact Modulated Amplifier.—Perkin-Elmer Corporation. (*Rev. sci. Instrum.*, Dec. 1946, Vol. 17, No. 12, p. 560.) Notice of manufacture of the amplifier described in 2629 of 1946 (Liston, Quinn, Sargeant & Scott). It is designed to replace sensitive suspension galvanometers; various applications are indicated.

621.317.715.085.39 **1513**

A Simple Galvanometer Amplifier with Negative Feedback.—D. G. Prinz : J. S. Preston. (*J. sci. Instrum.*, Dec. 1946, Vol. 23, No. 12, pp. 301–302.) Comment on 3670 of 1946, and Preston's reply.

621.317.725 **1514**

A Very High Impedance R.M.S. Voltmeter for Iron Testing.—D. C. Gall & F. C. Widdis. (*J. sci. Instrum.*, Dec. 1946, Vol. 23, No. 12, p. 287.) A valve amplifier, with high input impedance, which "has no voltage gain but a high power gain, giving in effect a very high impedance to the a.c. voltmeter which it operates. The ratio of input to output is linear."

621.317.727.025 **1515**

Alternating Current Potentiometer.—S. Holmqvist. (*Ericsson Rev.*, 1946, Vol. 23, No. 4, pp. 297–307.) The required a.c. quantities are transformed thermally into d.c. voltages, which are measured with d.c. potentiometers. Circuit diagrams are given for power, current and voltage measurement.

621.317.73 **1516**

A Visual Null Indicator for Impedance Bridge Measurements at Radiofrequencies.—P. J. Brine & J. W. Whitehead. (*Rev. sci. Instrum.*, Dec. 1946, Vol. 17, No. 12, pp. 537–539.) Greater accuracy in balance is obtained by applying the detector amplifier output to one pair of plates of a c.r. tube, and the modulated output of the r.f. oscillator to the other pair. A straight line trace indicates balance. Using this indicator with a General Radio Type 916A bridge, impedance measurements to an accuracy of 0.2 Ω can be made in the presence of interference levels more than 40 db above 1 μV.

621.317.79 : 621.397.62 **1517**

Television Synchronizing Signal Generating Units : Part 1.—R. R. Batcher. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 50–54 . . 144.) Describes picture and synchronizing test equipment for studio, laboratory and receiver production lines.

621.317.794 **1518**

The Organic Thermistor Bolometer.—C. D. Niven. (*Canad. J. Res.*, Nov. 1946, Vol. 24, Sec. A, No. 6, pp. 93–102.) Tests of a bolometer using a cellophane film painted with aquadag show it to be much inferior to the inorganic thermistor developed at the Bell Telephone Laboratories, particularly as regards drift and speed of response.

621.396.611.4 : 538.569.4 **1519**

Theory of a Microwave Spectroscope.—W. E. Lamb, Jr. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 308–317.) A discussion of (*a*) the measurement of the exponential decay of the radiation in an untuned echo box between pulses of radio-frequency power, and (*b*) the steady-state response of a large untuned cavity.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

518.5 **1520**

Calculations and Electronics.—(*See* 1493.)

537.533.7 **1521**

Imperfections of Shape in Electron-Optical Instruments.—F. Bertein. (*C. R. Acad. Sci., Paris*, 13th Jan. 1947, Vol. 224, No. 2, pp. 106–107.)

539.16.08 **1522**

Design of a Proportional Counter for Gamma-Rays.—B. B. Benson. (*Rev. sci. Instrum.*, Dec. 1946, Vol. 17, No. 12, pp. 533–536.)

539.16.08 **1523**

A Universal Radiation Measurement Apparatus, Its Description, Operation and Possible Applications.—R. Reiter. (*Z. InstrumKde*, April/June 1944, Vol. 64, Nos. 4/6, pp. 105–121.) An instrument for use with counters, having a special capacitor arrangement and suitable not only for single impulse counting but for reading the relative values of large radiation quantities from galvanometer deflexions. Various applications include the recording of the intensity characteristics of X rays and of all kinds of corpuscular radiation.

550.837 : 621.39 **1524**

The Development of Electrical and Radio Methods of Geophysical Prospecting.—V. Fritsch. (*Radio Tech., Vienna*, June/July 1946, Vol. 22, Nos. 2/3, pp. 139–146.) A review of present-day d.c., a.f. and h.f. methods, with applications to ore, coal and oil prospecting, water detection, investigation of building sites, and lightning protection.

621.317.39 : 531.768 **1525**

Acceleration Measurement by Wireless Methods.—G. Loeser. (*Z. InstrumKde*, Jan./March 1944, Vol. 64, Nos. 1/3, pp. 30–46.)

621.317.7.082.78.085.31 **1526**

Electronic Position Pickup.—Moore. (*See* 1511.)

621.317.794 : 535.61-15 **1527**

A Fast Superconducting Bolometer.—D. H. Andrews, R. M. Milton & W. DeSorbo. (*J. opt. Soc. Amer.*, Sept. 1946, Vol 36, No. 9, pp. 518–524.) For detection of infra-red signals. A ribbon of CbN is used at an operating temperature of about 15° K which can be maintained with the aid of liquid hydrogen and nitrogen for several hours. The primary response time is about 5×10^{-4} sec at about 3 000 c/s while the noise level is 5×10^{-4} μW. The apparatus has a secondary response time of 5×10^{-2} sec at about 140 c/s.

621.318.572 **1528**

Modern Geiger-Muller Counters.—Graves. (*See* 1364.)

621.365 **1529**

Electronic Heating.—M. Doucerain. (*Bull. Soc. franç. Élect.*, Oct. 1946, Vol. 6, No. 62, pp. 498–509.) Describes applications to the heat treatment of wood, rubber and plastic materials. H.F. heating should not in all cases be substituted for other methods when these are more economical.

621.365.5.029.5 **1530**

High Frequency Induction Heating.—E. May. (*Machinery, Lond.*, 9th & 23rd Jan. 1947, Vol. 70, Nos. 1787 & 1789, pp. 45–49 & 109–110.) Abstract of a paper read before the Institution of Production Engineers.

621.38 : 6 **1531**

Industrial Electronics.—H. A. Thomas. (*Elect. Times*, 23rd Jan. 1947, Vol. 111, No. 2883, pp. 104–106.) Summary of I.E.E. paper and discussion.

621.38.001.8 **1532**

The Application of Electronics.—W. Wilson. (*Beama J.*, Dec. 1946, Vol. 53, No. 114, p. 440.) Discusses applications in both light and heavy engineering. Abstract of paper in *Machinery Lloyd*, 19th Oct. & 2nd Nov. 1946, Vol. 18, Nos. 21A & 22A, pp. 37–43 & 37–47.)

621.38.001.8 **1533**

Opinion Meter.—(*Electronics*, Jan. 1947, Vol. 20, No. 1, p. 198.) To integrate the votes of large groups. Each voter sets a hand device, connected to the meter, to the degree of positive or negative opinion he holds.

621.38.001 : 620.18 **1534**

The "Talysurf" Surface Meter.—(*Electronic Engng*, Nov. 1946, Vol. 18, No. 225, p. 351.) A description of a stylus type of instrument manufactured by Taylor, Taylor & Hobson for measuring the textures of surfaces. High magnifications of surface irregularities are produced electrically and displayed graphically.

621.383.001.8 **1535**

Electronic Spectroscopy.—G. C. Sziklai & A. C. Schroeder. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 763–767.) Double differentiation of the signal from a photocell, to which a saw-tooth voltage is applied, enables the spectral distribution of the light incident on the cell to be observed on a c.r.o. The method is directly applicable to colour matching.

621.383.001.8 : 614.715 **1536**

Photoelectric Dust Meter.—G. F. Barnett & A. L. Free. (*Electronics*, Dec. 1946, Vol. 19, No. 12, pp. 116–119.) A photocell in an illuminated air duct continuously measures the quantity of light reflected by dust particles passing through the system. Applications include testing and rating the efficiency of air-cleaning devices.

621.384.6 + 537.291 **1537**

Resonance Acceleration of Charged Particles.—E. M. McMillan. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, p. 800.) Discussion of phase stability leads to a simple solution of the problem of keeping the particles in step with the accelerating field for a very large number of cycles. Descriptions of the 300 MeV synchrotron and the 184-inch synchro-cyclotron now under construction at Berkeley will be given later, with a discussion of future possibilities, leading to the eventual attainment of the billion-volt range. Summary of Amer. Phys. Soc. paper.

621.384.6 **1538**

Electron Radiation in High Energy Accelerators.—J. Schwinger. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 798–799.) A discussion of the limitation to the attainment of very high energy electrons, in devices such as the betatron and synchrotron, due to the radiative energy loss accompanying the circular motion of the electrons. Summary of Amer. Phys. Soc. paper.

621.384.6 **1539**

Development of Electron Accelerators.—(*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 170 . . 184.) A brief description of the principles of operation of linear accelerators, cyclotrons, synchrotrons and betatrons. Their limitations are explained. Medical applications are indicated.

621.384.6 **1540**

Preliminary Studies on the Purdue Microwave Electron Accelerator.—R. O. Haxby, E. S. Akeley, A. Ginzbarg, R. N. Smith, H. W. Welch & R. M. Whaley. (*Phys. Rev.*, 1st/15th Nov. 1946, Vol. 70, Nos. 9/10, pp. 797–798.) Summary of Amer. Phys. Soc. paper.

621.384.6 **1541**

The Betatron.—W. Bosley. (*J. sci. Instrum.*, Dec. 1946, Vol. 23, No. 12, pp. 277–283.) An historical account of its development and some details of particular instruments.

621.384.6 **1542**

The Theory of the Synchrotron.—D. Bohm & L. Foldy. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 249–258.)

621.384.6 **1543**

Magnetic Fields due to Dee Structures in a Synchrotron.—A. F. Clark. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, p. 444.) Method of measurement of the out-of-phase fields due to eddy currents in the metal dee. Summary of Amer. Phys. Soc. paper.

621.385.833 + 537.533.72 **1544**

Properties of Some Electrostatic Lenses.—H. Bruck & L. Romani. (*Cah. Phys., Paris*, Oct. 1944, No. 24, pp. 15–28. Reprint.) The cardinal elements and the spherical and chromatic aberrations of a series of independent electrostatic lenses are determined from their constructional parameters. The term 'independent lens' is used to distinguish such lenses from immersion lenses. Study of the effect of diaphragms or near objects leads to some new results. All the results are obtained from experimental values of the potential measured in an electrolytic bath with sloping base.

621.385.833 **1545**

Effect limiting the Possibilities of the Electron Microscope.—L. de Broglie. (*C. R. Acad. Sci., Paris*, 29th April 1946, Vol. 222, No. 18, pp. 1017–1019.) Movement of the object due to impacts from the irradiating source may result in reduced image sharpness, particularly when the source uses particles more massive than electrons. This effect is discussed.

621.385.833 **1546**

Supplementary Bibliography of Electron Microscopy.—M. E. Rathbun, M. J. Eastwood & O. M.

Arnold. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 759–762.) References not included in the list of Marton & Sass (1008 of 1946).

621.386.1 **1547**

X-Ray Generators at 1 000 and 2 000 kV.—J. Saget. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1946, Vol. 6, No. 61, pp. 476–479.)

621.386.1 : 620.179.1 **1548**

Applications of Recent X-Ray Inspection Equipment.—J. L. Bach. (*Machinery, Lond.*, 21st Nov. 1946, Vol. 69, No. 1780, pp. 663–665.)

621.386.84 **1549**

Radiography and Microradiography by Secondary Electrons.—A. Saulnier & J. J. Trillat. (*Rev. sci., Paris*, May 1945, Vol. 83, No. 3244, pp. 211–214.) Penetrating X rays from a tube operated at 150 kV or more are passed through a sheet of lead 0.2 mm thick and the secondary emission from the lead is used to obtain radiograms of thin objects, such as butterfly wings, onion skin, etc., interposed between the lead and a sheet of photographic paper.

621.39 : 578.088.7 **1550**

Electroencephalographic Technique from an Engineer's Point of View.—W. G. Egan. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 1000–1004.) A general description of equipment and of a new type of electrode. Methods of improving calibration accuracy and recorder performance are suggested.

621.396.645 : 621.43.019.8 **1551**

Constant-Gain Knock Pickup Amplifier.—R. P. Krebs & T. Dallas. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 87–89.) "Cathode-follower input, special feedback circuit, and simplified phase inverter stage provide flat frequency response from 8 to 20 000 cycles with a gain of 160 000 for portrayal of knock patterns of internal combustion engines on a cathode-ray oscilloscope."

621.396.932.078 + 621.396.664 **1552**

Radio Controlled Buoys.—Hopkins & Smith. (*See* 1454.)

621.43 **1553**

Improved Electronic Engine Indicator.—A. H. B. Walker. (*Engineering, Lond.*, 18th Oct. 1946, Vol. 162, No. 4214, pp. 361–364.)

621.791.3 : 621.365.5 **1554**

High-Speed Assembly of Radiators by Induction Soldering.—(*Machinery, N.Y.*, Dec. 1946, Vol. 53, No. 4, pp. 166–167.)

623.454.25 : 621.396.9 **1555**

Radio Proximity-Fuze Development.—W. S. Hinman, Jr., & C. Brunetti. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 976–986.) A description of fuses for smooth-bore projectiles. The oscillating detector, amplifier, power supply unit and safety arrangements are described in some detail, together with methods of production and testing.

PROPAGATION OF WAVES

538.566 **1556**

The Propagation of Electromagnetic Waves in Two or More Successive Media and the Diffraction of These Waves Referred to the Study of Cauchy's Problems.—Robin. (*See* 1413.)

621.396.11 : 523.746 : 551.510.535 **1557**

Effect of Sunspot Cycles on Long Distance Radio Signals.—Stetson. (*See* 1420.)

621.396.11 : 551.510.535 **1558**

The Role of the Ionosphere in the Propagation of Radio Waves.—Jouaust. (*See* 1447.)

621.396.41.029.64 **1559**

Calculation of Multiplex U.H.F. Radio-Telephony Links [100–5 000 Mc/s].—H. Chireix. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1946, Vol. 6, No. 61, pp. 415–424.) In three parts. The first part discusses the effect of various types of aerial on received power for given power radiated, and the effect of aerial and receiver height using the height-gain formulae of Eckersley (1660 of 1937) and of van der Pol & Bremmer (3245 of 1937, 35 and 3102 of 1938). The second part is a discussion of the noise factor of various systems, single and multiplex, with various types of modulation, with and without relays. The ranges considered are of the order of 50 km ; i.e., up to approximately optical range. In the third part long-distance communication is discussed for a range of 200 km, and the possibility of using various reflector systems as 'passive relays' is considered.

621.396.8.029.62 **1560**

The World above 50 Mc/s.—E. P. Tilton. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 50–54 . . 116.) Reports of amateur transmissions on frequencies of 50 Mc/s and above with a special reference to the first transatlantic communication on 50 Mc/s using F_2-layer reflection.

621.396.812.029.56 **1561**

Short Skip on Five Metres.—O. J. Russell. (*Short Wave Mag.*, Jan. 1947, Vol. 4, No. 11, pp. 670–675.) Analysis of 5 m propagation data suggests the presence of a short but persistent skip effect of 60 miles, possibly accounted for by a very low ionized layer at a height of 5–10 miles.

621.396.812 + 538.569.4]029.64 : 551.57 **1562**

Water Vapor Absorption of Electromagnetic Radiation in the Centimeter Wave-Length Range.—G. E. Becker & S. H. Autler. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 300–307.) An experimental investigation of absorption in water vapour in the region of the longest wavelength rotational absorption line, which has been shown to be centred at about 1.34 cm wavelength. The basis of the method is the determination of the Q of an 8-ft cubical copper cavity, maintained at 45°C, the air pressure being one atmosphere, and the partial pressure of water vapour being varied between 1 and 55 mm Hg. The absorption line is broadened as the water vapour density is increased. The wavelength range 0.7 cm to 1.7 cm was explored. The atmospheric attenuation of 1.34 cm waves is given as 0.025 db per km for 1 gm water vapour per cubic metre. A summary was given in 3719 of 1946.

621.396.812.029.74 **1563**

Research in England on the Propagation of Ultra-Short Waves.—Bras. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1946, Vol. 6, No. 61, pp. 480–495.) A review of the work already abstracted in 512 and 514–518 of February.

621.396.821 : 523.74 **1564**

Radio Effects observed during the Period of Solar Activity from 31st Jan. to 14th Feb. 1946.—R. Bureau. (*C. R. Acad. Sci., Paris*, 11th March 1946, Vol. 222, No. 11, pp. 597–599.) Atmospherics were recorded on various wavelengths from 24 000 m to 150 m and field strengths of the Geneva station on 48.66 m as a method of observing chromospheric activity. Sudden fade-outs of the decametre wave signal frequently coincided with sudden increases in intensities of atmospherics on 11 000 m; 24 000 m waves were less susceptible to disturbance. Disturbances of long duration on the decametre wavelengths indicate that solar activity is not limited to chromospheric eruptions.

RECEPTION

621.315.6 : 621.396.822] + 530.162 **1565**

The Response of Biased, Saturated Linear and Quadratic Rectifiers to Random Noise.—D. Middleton. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 778–801.) Rectification of broad-band and semi-broad-band noise gives roughly the same spectral distribution as that of the input, but narrow-band noise causes an infinite number of separate noise bands, centred about harmonics of the central frequency. Clipping of any sort always spreads the spectrum and reduces the output power. The behaviour of linear and quadratic rectifiers is qualitatively similar in most cases. The powers in the d.c. and continuous portions of the output spectrum are independent of the spectral shape of the incoming noise.

621.396.619.11/.13 **1566**

Frequency and Amplitude Modulation.—R. Aschenbrenner. (*Radio en France*, 1947, No. 2, pp. 8-14.) A theoretical discussion of a method of comparison, with experimental verification. With no signal, background noise is worse in the f.m. receiver. When signals are being received, it practically disappears in the f.m. receiver, but remains unchanged in the a.m. receiver. Reception of music was much better with the f.m. receiver. Side-band effects are also discussed.

621.396.62 **1567**

The Radio L.L. Synchrovox 645A Receiver.—(*Radio en France*, 1947, No. 2, pp. 23–25.) Complete technical description with performance characteristics.

621.396.62 **1568**

Converting the BC-348-Q.—P. M. Kersten. (*QST*, Jan. 1947, Vol. 31, No. 1, pp. 19–21..104.) Modifications necessary to make a surplus receiver suitable for amateur use.

621.396.621.54 **1569**

Method of Plotting Tracking Error.—E. B. Menzies. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 128–130.) A beat frequency method.

621.396.722(4)" 1939/45 " **1570**

Radio Technique in Europe during the War: Part 2.—H. Baumgartner. (*Radio Tech., Vienna*, June/July 1946, Vol. 22, Nos. 2/3, pp. 104–109.) An account of the general features of various German, Swedish and Austrian broadcasting receivers, including small mains sets and portables, and a fuller description, with circuit diagram, of an Austrian super-midget mains set.

621.396.812 : 523.5 **1571**

On the Detection of Meteors by Radio.—Manning, Helliwell, Villard & Evans. (*See* 1417.)

621.396.822 : 621.383 **1572**

Calculated Frequency Spectrum of the Shot Noise from a Photo-Multiplier Tube.—Sard. (*See* 1628.)

621.396.822 : 621.396.621.53 **1573**

Noise-Figure Reduction in Mixer Stages.—M. J. O. Strutt. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 942–950.) An analysis is given of random noise in mixer stages and its effect on proper circuit design and feedback. Conditions for optimum gain in a diode mixer stage are shown to be identical with those for minimum noise. Noise figures for triode and multi-grid mixer stages are related to those of a comparable triode amplifier.

621.396.822 : [621.396.694 + 621.396.615.142 **1574**

Shot Effect and the Receiving Sensitivity of Transit-Time Valves of Different Types.—F. Lüdi. (*Helv. phys. Acta*, 21st Sept. 1946, Vol. 19, No. 5, pp. 355–374.) The fundamental Schottky equation is extended and applied to calculations of the receiving sensitivity, neglecting the noise of the input resistance and assuming half the received power to be available at that resistance. The calculations show that for all transit-time types of valve the equivalent input resistance, (i.e., the valve noise) is much greater than the resistance noise. The results for the different types are summarized and compared with one another and with triode sensitivity. From this it appears that only heterodyne reception is capable of giving a satisfactory sensitivity for microwaves.

621.396.822.029.6 : 523 **1575**

Disturbances of Extraterrestrial Origin in the Short Wave Band.—J. L. Steinberg & J. Denisse. (*Rev. sci., Paris*, 15th Sept. 1946, Vol. 84, No. 3257, pp. 293–294.) Historical survey of galactic and solar noise, from Jansky's observations in 1932 to the recent work of Reber, Southworth, Appleton and Hey. Recent theoretical work on noise in valves and aerials and from interstellar matter is briefly discussed.

621.396.828.1 : 621.394.141 **1576**

Shorting Gate Noise Suppressor [for morse reception].—(*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, p. 55.) With no signal, incoming and set noise, after amplification, limiting and rectification, are used to control a tone generator. The excess voltage due to the signal operates a gating circuit which cuts out the tone completely. The result is silence during the signal and a note of constant amplitude during spacing, which can be used for operating printers or automatic equipment. For another account see *Electronics*, Jan. 1947, Vol. 20, No. 1, p. 150.

STATIONS AND COMMUNICATION SYSTEMS

534.861 **1577**

The Acoustic Problems of Broadcasting.—Braillard. (*See* 1307.)

621.395.44.029.62/.64 **1578**

A Microwave Relay System.—L. E. Thompson. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 936–942.) The system is based on double frequency modulation in which the carrier is frequency modulated by a sub-carrier, which is frequency or phase modulated by the intelligence. The signal/noise ratio and distortion in such a system are discussed and compared with those of a single frequency modulation system. An experimental two-way radio link is described in which double frequency modulation is used with carrier and sub-carrier frequencies of about 3 000 Mc/s and 1 Mc/s respectively. The link consists of three sections, each about 30 miles long, and two frequency channels are used for the complete two-way circuit. At each relay station the transmitters in both directions are on the same channel frequency, the two receivers operating on the other channel frequency.

621.395.623.8 **1579**

United Nations Broadcasting and Sound System.—(*See* 1315.)

621.396.1 **1580**

Planning the Amateur Bands.—(*Short Wave Mag.*, Jan, 1947, Vol. 4, No. 11, pp. 680–681.) A suggested division of each amateur band into c.w. and telephone zones.

621.396.1 **1581**

The Moscow Conference on Telecommunications.—Loyen. (*Onde élect.*, Dec. 1946, Vol. 26, No. 237, pp. 479–480.) A short review of the objects and recommendations of the conference from 28th Sept. to 21st Oct. 1946. See also 871 of March.

621.396.41.029.64 **1582**

Calculation of Multiplex U.H.F. Radio-Telephony Links [100–5 000 Mc/s].—Chireix. (*See* 1559.)

621.396.619 **1583**

Modern Modulation Systems.—P. Güttinger. (*Bull. schweiz. elektrotech. Ver.*, 15th June 1946, Vol. 37, No. 12, pp. 326–332. Reprint. In German with French summary.) Systems requiring a wide frequency band, such as f.m. or pulse-time modulation, are discussed and various combined systems are tabulated.

621.396.619.11/.13 **1584**

Frequency and Amplitude Modulation.—Aschenbrenner. (*See* 1566.)

621.396.619.16 **1585**

Pulse Technique.—R. Lemas. (*Télévis. franç.*, Jan. 1946, No. 9, pp. 14–17.) A general description of various methods.

621.396.65 **1586**

Considerations on Multiplex Links by Hertzian Cables [i.e., radio links].—J. Maillard. (*Onde élect.*, Nov. 1946, Vol. 26, No. 236, pp. 418–420.) A general discussion, from the economic point of view, of the relative merits of modulation and pulse systems for multiplex operation of radio links. It is concluded that pulse systems present definite advantages, since the economy of a multiplex radio link is determined much less by the performance of the link itself (i.e., signal/noise ratio, frequency band used) than by the cost of the accessory equipment.

621.396.65.029.64 **1587**

The Principal Factors affecting Radio-Multiplex Telecommunication Systems on Ultra-Short Waves.—V. A. Altovsky. (*Onde élect.*, Nov. 1946, Vol. 26, No. 236, pp. 401–417.) A detailed discussion of the problems involved in the design and setting up of multiplex radio-telephony links on wavelengths from 30 cm to about 1 cm, including (*a*) the requirements of the service and criteria of quality, (*b*) choice of modulation, (*c*) choice of frequency and (*d*) number of relay stations. Design details are given for a 200-channel telephony link to connect Paris and Lyons (about 300 miles), using a 6 cm wave and a 20 Mc/s f.m. band. Some particulars are also given of actual installations in the U.S.A. and France and of the No. 10 equipment used during the war in Europe by the British army.

621.396.712 **1588**

Status of Broadcasting Overseas.—A. Huth. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 56–58 . . 146.) Discusses the effect of the war on the transmitter and receiver situation in countries outside the U.S.A.

621.396.931 **1589**

Railroads plan Greater Use of Radio for Communications.—J. Peterson. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 78–83 . . 153.) Discusses existing equipment and future developments.

621.396.931.029.62 **1590**

Tests confirm Efficiency of 72 Mc/s for Mobile Radio.—G. H. Underhill. (*Elect. World, N.Y.*, 1st Feb. 1947, Vol. 127, No. 5, pp. 48–51.) Field tests in a typical eastern mountainous area indicate that the performance of a 72-Mc/s system is much better than would be expected from line-of-sight considerations. The Central Hudson Gas and Electricity Corporation is now installing a 75.66-Mc/s system.

621.396.932 : 621.396.5 **1591**

Multi-Channel Radiotelephone for Inland Waterways.—G. G. Bradley. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 74–77 . . . 149.) The special problems of ship-to-shore radio telephone communication on the Great Lakes are discussed, and equipment recently designed for this service is described.

SUBSIDIARY APPARATUS

620.197.122 **1592**

Pressure Sealing Zip Fastener.—(*J. sci. Instrum.*, Oct. 1945, Vol. 22, No. 10, p. 198.) The fastener is waterproof and prevents the escape of air or gases by means of overlapping rubber lips attached to each side of the line to be sealed.

621.314.6 + 621.319.4 + 621.383] : 669.018 **1593**

Light Alloys in Metal Rectifiers, Photocells, and

Condensers.—Continuing the series in *Light Metals* mentioned in 1226 of April and back references.

(xvii) Jan. 1946, Vol. 9, No. 96, pp. 9–21.

Discusses the manufacture of fixed-paper capacitors, with particular reference to the properties, handling, and processing of the aluminium foils employed.

(xviii) March 1946, Vol. 9, No. 98, pp. 144–151.

The manufacture of fixed paper capacitors is further considered, with special reference to the manipulation of the foil and the impregnation of the paper. See also pp. 163–166 of the same issue.

(xix) April 1946, Vol. 9, No. 99, 215–220.

Discusses the final stages in the production of fixed capacitors.

(xx) May 1946, Vol. 9, No. 100, pp. 231–235.

Discusses the materials employed in the sealing and potting of fixed paper capacitors.

(xxi) June 1946, Vol. 9, No. 101, pp. 318–325.

Practical considerations of the final production stages of capacitor manufacture.

621.314.63 **1594**

Applications of Dry Rectifiers.—Girard. (*See* 1469.)

621.316.722.078.3 **1595**

Improvement of Various Arrangements for Voltage Stabilization.—J. Benoit. (*C. R. Acad. Sci., Paris,* 13th Dec. 1943, Vol. 217, No. 24, pp. 597–599.) A bridge arrangement of resistors and accumulator batteries, with a neon stabilizing tube in one of the arms, is described. This gives much smaller voltage variations than the usual stabilovolt arrangements. Similar improvement is possible for any voltage stabilizer whose internal impedance is not negligible.

621.316.722.078.3 : 537.525.3 **1596**

Characteristics of the Pre-Corona Discharge and Its Use as a Reference Potential in Voltage Stabilizers.—S. C. Brown. (*Rev. sci. Instrum.,* Dec. 1946, Vol. 17, No. 12, pp. 543–549.) Studied particularly in terms of current and voltage characteristics. The use of a diode to give a constant reference potential depends on the high sensitivity of current to changes in voltage. Factors to be considered in design are discussed. A summary was noted in 3758 of 1946.

621.522.4 **1597**

Tests on a Metal Self-Fractionating Oil Diffusion Pump.—H. Wachter & J. W. A. van der Scheer. (*Z. tech. Phys.,* 1943, Vol. 24, Nos. 10/12, pp. 287–291.) An account of tests on an American pump, MF 250, made by Distillation Products, Rochester, N.Y. The pump is of relatively small dimensions, has a speed of about 250 litres/sec and with a rotary backing pump will reach a pressure of 6×10^{-7} tor.

TELEVISION AND PHOTOTELEGRAPHY

621.397.262 **1598**

Television System with Mixed Amplitude and Frequency Modulation, for the Transmission on a Single Carrier Wave of the Video, Synchronizing and Audio Signals.—M. Chauvierre. (*Radio en France,* 1945, No. 4, pp. 38–44.) Successive modulation in amplitude and in frequency of the carrier wave gives two independent channels for video and synchronism signals. Line synchronism corresponds to a frequency variation in one sense with respect to the carrier and image synchronism to a frequency variation in the opposite sense, so that a phase inversion followed by a limiter gives absolute separation of the two synchronizing signals. Application of a.f. modulation gives a complete television system on a single carrier wave ; such a system has been realized in practice with a transmitter of several watts.

621.397.262 **1599**

Television System with Single Carrier Wave and Frequency and Amplitude Modulation.—F. Vaglio. (*Radio en France,* 1945, No. 4, pp. 46–47.) Proposes a television system with simultaneous amplitude and frequency modulation of a single carrier wave.

621.397.3.012.3 **1600**

Vertical and Horizontal Definition in Television Systems.— J. A. Widemann. (*Télévis. franç.,* Dec. 1945, No. 8, pp. 2–4.) An abac is given from which the two definitions can be found for any system of television, given the number of lines and of images and the cut-off frequency.

621.397.331 **1601**

Considerations on the Bedford Velocity-Modulation Television System.—P. J. Freulon. (*Télévis. franç.,* Dec. 1945, No. 8, p. 11.) For original paper of Bedford & Puckle, see 1934 Abstracts, p. 506.

621.397.5 **1602**

Two Systems of Color Television.—D. G. Fink. (*Electronics,* Jan. 1947, Vol. 20, No. 1, pp. 72–77.) A general discussion on the relative merits of the sequential and simultaneous systems. Both provide good fidelity of colour transmission, without flicker, if bandwidth, frame frequency, etc., are suitably chosen. As simultaneous colour transmission can be reproduced in black-and-white by existing receivers, the transition to colour television will be easier on this system. For examples of each system see 2051 and 2363 of 1946 and 1240 of April.

621.397.5 : 537.291 **1603**

Theory of the Electric Deflexion of Electron Beams.—J. Picht & J. Himpan. (*Elektrotech. Z.,* 17th May 1944, Vol. 65, Nos. 19/20, pp. 196–197.) Summary of a paper abstracted in 3091 or 1941.

621.397.5 : 621.391.63 **1604**

TV [television] **on Modulated Light-Beam.**—(*Tele-Tech,* Jan. 1947, Vol. 6, No. 1, pp. 96..98.) Describes the transmission of video signals over short distances by means of a light-beam carrier system employing a cathode-ray tube as the modulated light source and a multiplier-type photocell receiver.

621.397.5 : 621.396.67 **1605**

Line-of-Sight Aerials [antennes de vision].—Tabard. (*See* 1339.)

621.397.61 **1606**

Television Transmission Centre, Paris.—H. Delaby. (*Télévis. franç.,* March 1946, No. 11, pp. 4–8.) A general account of the present Eiffel Tower equipment, with proposed extensions to relay stations.

621.396.615.17 : 621.316.729 : 621.397.5 **1607**

A Simplified Generator for Synchronizing Signals.—(*Radio en France*, 1947, No. 2, pp. 39–42.) Circuit and constructional details of simple and comparatively inexpensive equipment.

621.397.62 **1608**

The Main Types of Faults in a Television Receiver.—R. Aschen. (*Télévis. franç.*, Jan. & Feb. 1946, Nos. 9 & 10, pp. 4–5..21 & 6.)

621.397.62 **1609**

Large Television Screens and Their Evolution.—Hemadinquer. (*Télévis. franç.*, March 1946, No. 11, pp. 17–18..27.) Outlines the development of large-surface multi-cell screens.

621.397.62 **1610**

Television for Today: Part 7—Video Detector Circuits.—M. S. Kiver. (*Radio Craft*, Dec. 1946, Vol. 18, No. 3, pp. 29..61.) Discusses full-wave detection circuits, the use of peaking-coil filters and polarity.

621.397.62 **1611**

Pye [television] **Receiver Type B16T.**—(*Radio en France*, 1947, No. 2, pp. 43–48.) A general description, with circuit details.

621.397.62 **1612**

Carrier-Difference Reception of Television Sound.—R. B. Dome. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 102–105.) Use of a common i.f. amplifier for video and sound signals eliminates the effects of local oscillator hum and frequency drift. The overall i.f. bandwidth is greater than the carrier difference frequency, and by the use of absorption trap circuits, the sound i.f. level is kept below the minimum level expected from the picture carrier. The two signals are then separated. A receiver incorporating this system is reliable in performance, and costs are reduced.

621.397.62 : 621.317.79 **1613**

Television Synchronizing Signal Generating Units: Part 1.—Batcher. (*See* 1517.)

TRANSMISSION

621.316.726.078.3 : 621.396.619.13 **1614**

Carrier Stabilization in Frequency-Modulated Transmitters.—G. Guanella. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 193–197.) Several automatic control methods are briefly described, with block diagrams. (*a*) An a.c. voltage of lower frequency is derived by heterodyning with a stable reference frequency and is used for control through a frequency discriminator. (*b*) Modulation of a stable two-phase voltage by a fraction of the carrier voltage gives a rotating field which is used for retuning. (*c*) Modulation of a two-phase voltage, with differentiating and heterodyning, gives a control voltage proportional to frequency error. (*d*) The carrier frequency is compared directly with a suitable harmonic of a reference oscillator.

621.394.61 **1615**

New 10-kW Transmitter for Telegraphy.—E. Guyer & M. Favre. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 175–178.) The frequency range is 5.5–21 Mc/s with stability to one part in 10^5. The transmitter is designed for 3-phase 230/380 V 50-cycle supply and is capable of 450 w.p.m. A modulator attachment permits use for telephony.

621.396.61 : 621.394/.395].61 **1616**

Modern 1-kW Transmitter.—E. Meili. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 172–174.) A description, with illustrations, of a short-wave transmitter for λ 12.8–90 m and adaptable for either telephony or telegraphy. A Franklin oscillator with quartz control gives frequency stability of $\pm 2 \times 10^{-6}$.

621.396.61 : 621.396.619.13 **1617**

Engineering a 250 Watt BC Transmitter for F.M.—L. C. Killian & F. Hilton. (*Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 68–70.) Using the cascade phase-shift system.

621.396.61.029.54/.58 **1618**

The R.A.F. T.1154 Transmitter.—(*Short Wave Mag.*, Oct. 1946, Vol. 4, No. 8, pp. 499–501.) A brief description of a 100-W telegraphy/telephony aircraft transmitter with three frequency ranges: 200–500 kc/s, 3.0–5.5 Mc/s and 5.5–10 Mc/s.

621.396.61.029.58 **1619**

A 7/14-Mc/s Transmitter.—(*Short Wave Mag.*, Oct. 1946, Vol. 4, No. 8, pp. 481–483.) General description and performance of a 70-W amateur transmitter. See also *Short Wave Mag.*, July 1946, Vol. 4, No. 5, pp. 312–313.

621.396.61.029.58 **1620**

Five-Band 25-Watt Transmitter.—B. Randell. (*Short Wave Mag.*, Jan. 1947, Vol. 4, No. 11, pp. 664–669.) A combination of crystal oscillator and power amplifier which can be used either as a low-power transmitter or as an efficient exciter for a high-power r.f. amplifier. Data are included for operation on wavebands from 1.7 Mc/s to 28 Mc/s.

621.396.61.029.63 **1621**

Decimetre-Wave Transmitter giving 50-W Aerial Power.—R. Schweizer. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, p. 222.) A general description, with photographs but no operational details, of a transmitter with stabilized anode and heater voltages, suitable for field-strength measurements.

621.396.61.029.64 **1622**

Projectors of Centimetre Waves.—H. Gutton. (*Onde élect.*, Dec. 1946, Vol. 26, No. 237, pp. 459–466.) Calculation of the radiation from projectors is based on Huyghens' principle. Three types of projector are discussed: electromagnetic horns, reflectors and dielectric aerials as used by the Germans during the war.

621.396.615.14 **1623**

Ring Oscillators for U.H.F. Transmission.—T. Gootée. (*Radio News*, Jan. 1947, Vol. 37, No. 1, pp. 48–50..122.) An even number of 4 or more triodes of the same type are arranged in a ring and tuned by resonant lines to obtain greatly increased power output, 16 triodes giving about 8 times that of a pair in push-pull.

621.396.619.13 : 621.396.712 **1624**

New F.M. Broadcast Transmitters.—(*Bell Lab. Rec.*, Jan. 1947, Vol. 25, No. 1, pp. 20–23.) Three transmitters are illustrated and briefly described, rated at 1, 3 and 10 kW respectively. The last two consist of the 1-kW unit, together with power amplifiers. A frequency synchronization system is employed to control the carrier frequency.

621.396.619.23 **1625**

Overmodulation without Sideband Splatter.—O. G. Villard, Jr. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 90–95.) Full circuit details of a balanced modulator for incorporation in an a.m. phone transmitter, to produce modulation in excess of 100% without causing adjacent channel interference.

VALVES AND THERMIONICS

537.291 + 538.691 **1626**

The Paths of Ions and Electrons in Non-Uniform Crossed Electric and Magnetic Fields.—N. D. Coggeshall. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 270–280.) The force equations for a charged particle moving in such fields can be integrated by a very simple procedure under certain conditions. These conditions are satisfied when motion takes place in a median plane symmetrically situated relative to magnetic pole faces and electrostatic electrodes. Numerical integration can be used when the analytical difficulties are too great, or when the fields are only known empirically. A summary was noted in 3882 of 1945.

537.291 : 621.396.615.142 **1627**

Theory of Small Signal Bunching in a Parallel Electron Beam of Rectangular Cross Section.—E. Feenberg & D. Feldman. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1025–1037.) The non-uniform distribution of charge in the bunched beam gives rise to a field which opposes the bunching process so that a kinematic solution may be validly applied only for a limited length of the drift space. An accurate solution of the bunching process requires the integration of the dynamical and field equations which, for 'small signal' conditions, reduce to a linear homogeneous system. Solutions are obtained which are classified as non-solenoidal or solenoidal according as the motion produces or does not produce a high frequency charge density within the beam. The physical problem is solved by taking a suitable linear combination of both solutions, a large part of the solution for practical conditions being of the solenoidal type.

621.383 : 621.396.822 **1628**

Calculated Frequency Spectrum of the Shot Noise from a Photo-Multiplier Tube.—R. D. Sard. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 768–777.) A general expression for the power spectrum of the shot noise produced by a secondary-emission multiplier tube is applied to the RCA 931 family. It is deduced that the noise intensity should be constant from zero up to about 100 Mc/s, begin to fall off appreciably between 100 and 1 000 Mc/s and become very weak at higher frequencies.

621.385 **1629**

Beam Production in Radial Beam Tubes, Beam Power Tubes, and Other Low Voltage Electronic Devices.—A. M. Skellett. (*Rev. mod. Phys.*, July 1946, Vol. 18, No. 3, pp. 379–383.) In the magnetic focus radial beam valve, the beam is focused entirely by an external magnetic field of between 50 and 250 gauss and in the power tube by the action of the grid wires. Other tubes operating at 300 V or less include the 'magic eye' tuning indicator and the orthicon pickup tube in television systems.

621.385 : 621.371.329 : 518.6 **1630**

Electrostatic Field Plotting.—Balachowsky. (*See* 1495.)

621.385 : 621.317.7 **1631**

Portable Precision Valve Tester.—Haas. (*See* 1509.)

621.385.1.032.1.011.2 **1632**

Impedance of Gasfilled Tubes traversed by a High-Frequency Discharge.—P. Mesnage. (*C. R. Acad. Sci., Paris*, 10th July 1944, Vol. 219, No. 2, pp. 55–56.) Measurements were made with the tubes placed axially in inductance coils tuned to the frequency in use. Two types of discharge were found. In one the resistance is sensibly independent of the exciting field; in the other the resistance is a decreasing function of the field. The imaginary part of the impedance may have either sign and is equivalent to a capacitance for gases and to an inductance, decreasing with increasing field, for metallic vapours.

621.385.18.029.64 **1633**

Physical Processes in the Recovery of TR Tubes.—H. Margenau, F. L. McMillan, Jr., I. H. Dearnley, C. S. Pearsall & C. C. Montgomery. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 349–357.) Techniques are described for the measurement of the time of elimination of ions on termination of the discharge in TR tubes. The capture of electrons by gas molecules is found to be the principal factor in recovery.

621.385.3 **1634**

Development of a Water-Cooled Transmitting Triode of 50-kW Anode Dissipation.—F. Jenny. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 211–214.) The cathode consists of 12 tungsten wires, arranged for single-, three- or six-phase a.c. heating. The anode is of special electrolytic copper. Details of evacuation, test procedure and results are described.

621.385.3.029.63 **1635**

A Medium-Power Triode for 600 Megacycles.—S. Frankel, J. J. Glauber & J. P. Wallenstein. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1946, Vol. 34, No. 12, pp. 986–991.) An account of an air-cooled triode for delivering 25 kW peak pulse power at 600 Mc/s and of a water-cooled version for generating continuous waves giving up to 500 kW at the same frequency.

621.385.3.032.2 : 621.317.33 **1636**

Inter-Electrode Capacitances of Triode Valves and Their Dependence on the Operating Condition.—Mitra & Khastgir. (*See* 1501.)

621.385.38 **1637**

The New Thyratron, Sub-Miniature Type RK61 "Raytheon" and Its Applications.—(*Radio en France*, 1947, No. 2, p. 7.) Characteristics of a tube about 8 mm in diameter and 40 mm long.

621.385.38 : 537.525.6 **1638**

Initiation of Discharge in Arcs of the Thyratron Type.—C. J. Mullin. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 401–405.) From an equation derived for the anode current as a function of time during the initiation of the discharge, estimates of ionization time can be made which are of the correct order of magnitude.

621.385.4.029.6 **1639**

Resnatron may aid Radio.—(*Sci. News Lett., Wash.*, 1st Feb. 1947, Vol. 51, No. 5, p. 67.) The resnatron, used largely during the war for jamming on frequencies between 350 and 600 Mc/s, will give 140 kW at 450 Mc/s. Its special features are briefly described. See also 1732 and 3822 of 1946.

621.385.832 **1640**

A Cathode-Ray Tube for viewing Continuous Patterns.—J. B. Johnson. (*J. appl. Phys.*, Nov. 1946, Vol. 17, No. 11, pp. 891–900.) " A cathode-ray tube is described in which the screen of persistent phosphor is laid on a cylindrical portion of the glass. A stationary magnetic field bends the electron beam on to the screen, while rotation of the tube produces the time axis. When the beam is deflected and modulated, a continuous pattern may be viewed on the screen."

621.396.615.141.2 + 621.385.16 **1641**

Energy Build-Up in Magnetrons.—L. P. Hunter. (*J. appl. Phys.*, Oct. 1946, Vol. 17, No. 10, pp. 833–843.) An analysis neglecting the mechanism of conversion of the d.c. input into the r.f. output power. The magnetron is represented by its equivalent circuit. The law of build-up is derived from energy considerations and the dependence of starting time on load calculated. " The starting time is affected slightly by the initial noise level and becomes infinite below a minimum Q. For high Q values the starting time can be varied only by changing the energy stored in the line." A summary was noted in 291 of January.

621.396.615.141.2 **1642**

Self-Regulating Field Excitation for Magnetrons.—H. C. Early & H. W. Welch. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 184..188.) Stable magnetron operation is obtained by causing the anode current to excite the magnetic field.

621.396.615.141.2 **1643**

Background Noise and Audio Frequency Oscillations in Magnetrons.—É. Selzer. (*C. R. Acad. Sci., Paris*, 3rd April 1944, Vol. 218, No. 14, pp. 589–591.) Background noise is reduced considerably by accurate adjustment of parallelism of the field and the anode axis, but is not completely eliminated. Numerous bands of a.f. oscillations have been observed. Displacement of the operating point along the characteristic produces a continuous change of the frequency of these bands, which is increased by increase of the applied magnetic field. These results are discussed.

621.396.615.141.2 **1644**

Construction of Magnetrons of Great Symmetry and with Anodes Not Split. Study of Their Static Properties.—É. Selzer. (*C. R. Acad. Sci., Paris*, 20th March 1944, Vol. 218, No. 12, pp. 499–501.) Anodes of large diameter, about 9 cm, are turned from solid copper and sealed to two glass domes carrying the cathode system. Results of experiments with such magnetrons are discussed.

621.396.615.142 **1645**

From Transit-Time Effect to Transit-Time Valves : Parts 1 & 2.—L. Ratheiser. (*Radio Tech., Vienna*, Aug./Sept. & Oct. 1946, Vol. 22, Nos. 4/5 & 6, pp. 189–196 & 283–292.) Simple explanations are given of transit-time effects and the interaction between electrons and a.c. fields. The development of modern u.h.f. valves is traced from Barkhausen-Kurz retarding-field types to velocity-modulation valves. To be continued.

621.396.615.142 : 537.291 **1646**

[Electron] **Bunching in Velocity-Modulation Valves.**—J. Voge. (*C. R. Acad. Sci., Paris*, 1st July 1946, Vol. 223, No. 1, pp. 25–27.) A general treatment, taking into account electronic fields and showing one case where these fields do not modify the law of bunching obtained by neglecting them.

621.396.615.142.2 **1647**

Theory of Single-Circuit Clystrons.—S. Gvosdover & V. Lopukhin. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 275–284.) The mathematical solution of the interaction of an electron beam and the field of a cavity resonator is given. The amplitude and frequency of the resulting oscillations are determined in terms of the size and shape of the cavity and of the applied potentials. The small effects of the space charge are taken into account. The theory is applied to the single-resonator klystron or monotron.

621.396.615.142.2 **1648**

Mechanical Klystron for Demonstration.—(*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 138, 142.) A rocking motion imparted to a water jib causes bunching of the water droplets similar to electron bunching in the klystron.

621.396.694.011.3/.4 **1649**

Study of Electronic Reactance-Variation Devices.—Mazel. (*See* 1391.)

621.396.822 : [621.396.694+621.396.615.142 **1650**

Shot Effect and the Receiving Sensitivity of Transit-Time Valves of Different Types.—Lüdi. (*See* 1574.)

MISCELLANEOUS

001.891 (94) **1651**

Scientific Research in Australia.—(*Engineering, Lond.*, 3rd–24th Jan. 1947, Vol. 163, Nos. 4225–4228, pp. 5–6, 42–43, 53–54 & 89–90.) The nineteenth annual report of the Council for Scientific and Industrial Research covering a wide range of engineering and allied subjects, including for the first time the work of the Radiophysics Division.

001.98 **1652**

The False Preconceived Notion.—W. Burridge. (*Brit. med. J.*, 5th Oct. 1946, No. 4474, p. 516.) A letter suggesting that in the assessment of conflicting but apparently equally valid hypotheses, the element to reject is that on which all are in agreement, since this is likely to be the false preconceived notion which has engendered the contradictory conclusions.

016 : 05 **1653**

World List of Scientific Periodicals.—(*Nature, Lond.*, 30th Nov. 1946, Vol. 158, No. 4022, p. 785.) The third edition, to include all scientific and technical periodicals that appeared during 1900–1947, is in preparation.

061.6 **1654**

The British National Physical Laboratory.—H. Buckley. (*Sci. Mon., N.Y*, Jan 1947, Vol. 64, No. 1, pp. 50–52.) A general account of the organization and functions of the Laboratory. The importance of the association with industry is stressed.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.213.4 + 621.392.029.64 **1655**
Acoustic and Electromagnetic Wave Guides of Complicated Shape.—Krasnooshkin. (*See* 1666.)

534.756 + 621.39 **1656**
Theory of Communication.—D. Gabor. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, p. 58.) Summary of 1057 of April.

534.85 + 621.395.625 **1657**
Sound Recording and Reproduction.—R. V. Southey. (*Proc. Instn Radio Engrs, Aust.*, Dec. 1946, Vol. 7, No. 12, pp. 4–7.)

621.314.2.029.3 **1658**
Response of Audio-Frequency Transformers at High-Frequencies.—Webb. (*See* 1688.)

621.395.61 **1659**
Microphones and Receivers.—L. C. Pocock. (*J. Brit. Instn Radio Engrs*, June/Aug. 1943, Vol. 3, No. 5, pp. 197–215. Discussion, pp. 215–220.) A comprehensive paper dealing with (*a*) measurement of speech by means of a speech energy meter, which integrates electrical speech power by storing it as heat in a valve cathode, thus changing anode current, (*b*) the speech power to be delivered to a loudspeaker to produce a given reading on a noise meter in a standard position, (*c*) various kinds of microphones and their frequency characteristics, and the disturbance of free field due to the introduction of a microphone or of different listeners, (*d*) coupling between transducers and amplifying equipment, (*e*) distortion, including that due to a wrong level of reproduction, (*f*) equivalent networks, allowing for the dependence of acoustic impedances upon air density and pressure, (*g*) force factor, which is a measure of the coupling between the acoustic or mechanical side of the apparatus and the electrical or electromagnetic side, (*h*) future developments.

621.395.625 : 621.396.611.1 : 621.396.619 **1660**
Resonant Circuit Modulator for Broad-Band Acoustic Measurements.—Hull. (*See* 1702.)

621.395.625.3 **1661**
Magnetic Tape Recorder.—(*See* 1832.)

621.396.645.029.3 **1662**
High-Impedance Input Circuits for A.-F. Service.—Parry. (*See* 1715.)

AERIALS AND TRANSMISSION LINES

621.315.2.029.5 : 621.317.333.4 **1663**
New Methods for Locating Cable Faults, particularly on High-Frequency Cables.—F. F. Roberts. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, pp. 61–63.) Summary of 1002 of April.

621.315.212 **1664**
Determination of the Optimum Ratio of Conductor Diameters in Coaxial Cables.—K. O. Schmidt. (*Elektrotech. Z.*, 4th May 1944, Vol. 65, Nos. 17/18, pp. 170–173.) Methods in common use require too much copper. Expressions are derived which permit accurate calculation of the diameter ratio. Sets of curves show the correctness of the formulae used and enable the optimum ratio to be found for particular cables when the attenuation per km is given. The saving in copper, as compared with the usual methods, may be of the order of 20–30%.

621.315.212.2 : 621.317.336 **1665**
New Method of Measuring the Impedance Errors of Concentric Pairs.—Fuchs. (*See* 1848.)

621.392.029.64 + 534.213.4 **1666**
Acoustic and Electromagnetic Wave Guides of Complicated Shape.—P. Krasnooshkin. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 5, pp. 434–445.) Waves in hollow pipes of rectangular section and complicated shape are discussed. An equivalence

theorem is established relating a pipe of complicated shape to a straight cylindrical pipe filled with a non-uniform medium. Pipes having parabolic, elliptic and toroidal forms are discussed and reference is made to tunnel effect, band-pass effect and 'clinging phenomenon'.

621.392.029.64 **1667**

The Effect of the Curvature of a Waveguide on Propagation.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 26th Aug. 1946, Vol. 223, No. 9, pp. 380–381.) To a first approximation the curvature of a waveguide does not affect the phase velocity. For relatively great curvatures, an expression is here derived for the change of propagation constant in the case of $H_{n,o}$ waves in a rectangular curved guide and from this the change of phase velocity, group velocity and wavelength are at once obtained. The expression has no meaning if the frequency is equal to the cut-off frequency of the guide for zero curvature. Formulae for the field components and cut-off frequency are given which should be used near the cut-off frequency, in place of those previously given for the general case. See also 1320 of May and back references.

621.392.029.64 **1668**

The Effect of a Curvature Discontinuity on Propagation in Waveguides.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 23rd Sept. 1946, Vol. 223, No. 13, pp. 474–475.) The case is considered of an $H_{p,o}$ wave propagated in a guide of rectangular cross-section whose axis is curved in a plane perpendicular to the electric field. At a point where the curvature changes suddenly, parasitic waves and oscillations, all of the form $H_{n,o}$, occur in the two portions of the guide. Formulae are given for the ratio of the complex amplitudes of the perturbations in the two parts of the guide (*a*) for the general case of any frequency and (*b*) where the frequency is very near the cut-off frequency of the wave $H_{q,o}$, $(q + p)$ being odd. A loss factor, the ratio between the energy of the parasitic waves and that of the wave $H_{p,o}$, can be calculated. Owing to the abnormal excitation of the parasitic waves near the cut-off frequency, the loss factor shows a sharp rise. See also 1667 above.

621.392.029.64 **1669**

Rectangular Waveguide Systems.—N. Elson. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, pp. 44–54.) The mismatch at a discontinuity in a waveguide (expressed in terms of the percentage amplitude reflection coefficient) is determined for a chopped-off corner of various angles in the E and H planes at λ 10.8 cm, and an optimum design is deduced. Curves for the s.w.rs of various bends at λ 3.2 ± 0.1 cm are given. An analysis of the equivalent circuit of T- and Y-junctions is given and the results presented graphically. An appendix treats theoretically the location of the plane of minimum transverse current in a curved waveguide to determine the best position for a cut.

621.392.029.64 **1670**

Some Applications of the Principle of Variation of Wavelength in Wave Guides by the Internal Movement of Dielectric Sections.—G. E. Bacon & J. C. Duckworth. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 56.) Summary of 1321 of May.

621.392.029.64 : 538.3 **1671**

Quasi-Stationary Field Theory and Its Application to Diaphragms and Junctions in Transmission Lines and Wave Guides.—G. G. Macfarlane. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 63–64.) Summary of 1323 of May.

621.392.029.64 : 621.318.572 **1672**

The Rhumbatron Wave-Guide Switch.—A. Maclese & J. Ashmead. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 65.) Summary of 1325 of May.

621.392.029.64 : 621.396.662.3 **1673**

Filtering of Guided Waves.—J. Ortusi. (*Bull. Soc. franç. Élect.*, Nov. 1946, Vol. 6, No. 63, pp. 589–596.) A theoretical treatment is given of simple cavity resonators and of the effect in a waveguide of an obstacle formed by a conducting plate with a window. Two such windows in a waveguide constitute the simplest band-pass filter; a band-stop filter is obtained by means of a resonator coupled to the guide through an aperture in the wall. Band-pass filters are usually formed by a number of elementary cells with suitable coupling. Examples are given of the results obtained when four or more windows are used, with a description of the apparatus used to verify the theory.

621.392.029.64.091 **1674**

Calculation of Attenuation in Wave Guides.—S. Kuhn. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 61–63.) Summary of 1328 of May.

621.396.67.029.62 **1675**

A Stacked Array for 6 and 10 [metres].—E. P. Tilton. (*QST*, Feb. 1947, Vol. 31, No. 2, pp. 38–41.. 130.) Structural details and tuning procedure are given for a three-element array for 10 m, matched by means of a T section, and for a four-element 6-m array using a folded dipole, both being fed by 300-Ω lines.

621.396.671 : 621.396.611.33 **1676**

Matching Ranges [plages d'adaptation] **of Transmitters.**—Glazer & Familier. (*See* 1958.)

621.396.677 **1677**

Slotted-Cylinder Antenna.—E. C. Jordan & W. E. Miller. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 90–93.) A discussion of the properties with polar diagram and impedance data.

621.396.677 **1678**

Rhombic Aerials and Matching Circuits for Reception.—T. S. Rangachari, B. H. Paranjpye & G. S. Deshpande. (*Electrotechnics*, Dec. 1946, No. 19, pp. 19–31.) The practical design of these aerials to meet various common requirements and restrictions is discussed. The construction of a non-inductive weatherproof terminating resistor and of a matching transformer is described, with the transformer adjustment procedure required to eliminate reflection.

621.396.677 : 621.317.7 **1679**

Radio-Frequency Measurements on Rhombic Antennae.—Christiansen, Jenvey & Carman. (*See* 1857.)

621.396.677.029.58 **1680**

The Double Triplex Beam.—J. A. Biggs. (*CQ*, Jan. 1947, Vol. 3, No. 1, pp. 27–30.) Constructional details and performance of a directive array for use on long range amateur radio-telephony in the 20 m wavelength band.

621.396.677.029.63 **1681**

A Switched-Beam Directive Aerial on 600 Mc/s.—R. V. Alred. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 411–422.) The aerial has a cylindrical, parabolic reflector fed by a line of dipoles parallel to its axis. Particular problems in design for horizontal polarization, ease of production and installation aboard ships are discussed. A phasing system and mechanism for rapid switching of the direction of the beam are described, with an electrical method for correcting mechanical and electrical variations in production. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 322–323.

621.396.677.029.64 **1682**

A Dielectric-Lens Aerial for Wide-Angle Beam Scanning.—F. G. Friedlander. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 53–54.) Summary of 1358 of May.

621.396.677.029.64 **1683**

A Detailed Experimental Study of the Factors influencing the Polar Diagram of a Dipole in a Parabolic Mirror.—E. G. Brewitt-Taylor. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 57.) Summary of 1357 of May.

621.396.677.029.64 : 621.392.029.64 **1684**

Directive Couplers in Wave Guides.—M. Surdin. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 66.) Summary of 1359 of May.

621.396.677.029.64 : 621.392.029.64 **1685**

Resonant Slots.—W. H. Watson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 67.) Summary of 1360 of May.

621.396.679.4 : 621.315.24 **1686**

A Six-Wire Transmission Line Application.—J. C. Wadsworth. (*Proc. Instn Radio Engrs, Aust.*, Dec. 1946, Vol. 7, No. 12, pp. 7–11.) The required characteristics for feeding r.f. energy to a vertical aerial are obtained by a six-wire unbalanced transmission line, which has also the advantages of a concentric line.

621.396.96 : 621.396.82 **1687**

Radar Reflections from Long Conductors.—F. Bloch, M. Hamermesh & M. Phillips. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1015–1020.) When rolls of metallized strip are to be released by aircraft to give rise to strong back-scattering, the effective cross-section is of importance. The reflection pattern of a straight cylindrical conductor, of great length and small diameter compared to λ, has a sharp lobe perpendicular to its length. In practice a rope-like conductor deviates from this ideal condition and the effective cross-section becomes nearly independent of the instantaneous shape and orientation of the rope. Cross-sections have been derived assuming the shape to be a series of (*a*) helical turns (*b*) straight sections whose parameters are such that the scattering adds incoherently. The two assumptions give similar results.

The cross-section of a thin twisted ribbon conductor whose width d exceeds 0.75λ is almost the same for both parallel and transverse polarization. As d is decreased below 0.75λ, the cross-section for transverse polarization passes through a small maximum at $d = 0.5\lambda$ and then falls away rapidly.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2.029.3 **1688**

Response of Audio-Frequency Transformers at High-Frequencies.—E. K. Webb. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1944, Vol. 5, No. 3, pp. 3–12.) The response of loaded and unloaded audio frequency transformers at high audio frequencies is analysed and nomograms for numerical calculations are given. Constructional characteristics and the causes and effects of losses present are examined. Measurements for an interstage transformer show the order of accuracy to be expected in practice.

621.314.3 **1689**

Hum in High-Gain Amplifiers.—P. J. Baxandall. (*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 57–61.) The hum level in an a.c. mains-operated audio amplifier can be made negligible in comparison with the Johnson noise, for an input grid circuit having an impedance of the order of 50 kΩ. Causes of hum and practical means of eliminating it are discussed.

621.316.726.078.3 : 621.396.615.14 **1690**

Electronic Frequency Stabilization of Microwave Oscillators.—R. V. Pound. (*Rev. sci. Instrum.*, Nov. 1946, Vol. 17, No. 11, pp. 490–505.) Frequency control is achieved by feeding back to the oscillator a control voltage derived from an external cavity resonator coupled to the circuit by 'Magic Tee' waveguide sections to form a frequency discriminator; the cavity has a frequency-dependent reflection coefficient going through zero at resonance. Two particular control circuits of this type are described: the first uses two 'Magic Tee' sections and the reflected wave controls the relative outputs from two crystals, one in each section: the outputs are applied to the oscillator via a suitable low-pass amplifier. The second circuit uses a single 'Magic Tee' in which the reflected wave from the cavity goes to a crystal having an applied i.f. voltage. This crystal reflects amplitude-modulated sidebands with i.f. spacing on either side of the signal frequency. These mix with the signal frequency in a second crystal, using the i.f. oscillator as reference, and give a voltage which is amplified and applied to the microwave oscillator.

621.317.727 **1691**

Potentiometers.—L. A. Nettleton & F. E. Dole. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 356–363.) Discusses methods used to improve performance, including the use of 'Paliney' (an alloy of Pt, Pd, Au, Ag, Cu and Zn) wire for the contactor.

621.318.323.2.042.15 **1692**

Permeability of Dust Cores.—G.W.O.H. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, pp. 33–34.) The high effective permeability of dense dust cores can be attributed to the alignment of non-spherical particles in the direction of the magnetic field, though the cause of this alignment is obscure.

621.318.323.2.042.15 **1693**

Permeability of Dust Cores.—P. R. Bardell.

(*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, p. 63.) Measured permeabilities can be explained by assuming that the particles are uniformly coated rectangular slabs (dimension ratio 10 : 2 : 1) of permeability 1 000 and oriented with the long axis parallel to the magnetic field.

621.318.371.011.2/.4 **1694**

H.F. Resistance and Self-Capacitance of Single-Layer Solenoids.—R. G. Medhurst. (*Wireless Engr*, Feb. & March 1947, Vol. 24, Nos. 281 & 282, pp. 35–43 & 80–92.) Results of measurements on 40 coils wound with copper wire on grooved distrene formers. The resistances agree well with the values given by Butterworth's theory for widely spaced turns but are considerably lower for closely spaced turns. The magnification of a coil of mean radius R at frequency f can be represented by $Q = 0.15\, R\, \Psi \sqrt{f}$, where Ψ is a tabulated function of the length/diameter and spacing ratios. The self-capacitance is given by $C = HD$ $\mu\mu$F where D is the mean coil diameter and H is a tabulated function of the length/diameter ratio.

621.318.4.042.15 **1695**

Dust Ring-Core Coils and Their Possible Applications.—E. Ganz. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 219–221.) Describes some of the stock sizes of Brown Boveri dust rings and pots and discusses their use for frequencies up to 2 or 3 Mc/s.

621.392.52 + 537.228.1 **1696**

Progress in the Construction of Crystal Filters.—H. Biefer, H. Keller & B. Matthias. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 214–218.) The temperature coefficient of crystals of potassium and ammonium phosphate limits their application, but mixed crystals obtained by replacing ammonium by rubidium or thallium have a much lower temperature coefficient at room temperature. Methods of using length, thickness and bending vibrations for various frequency ranges are described and the properties of bridge-type filters illustrated. The simultaneous use in such filters of potassium and ammonium phosphate crystals gives very wide pass bands with sharp cut-off.

621.392.52 **1697**

Insertion Characteristics of Filters.—J. B. Rudd. (*A. W. A. tech. Rev.*, Dec. 1946, Vol. 7, No. 2, pp. 145–176.) Expressions are obtained for the insertion loss L and phase shift B of multi-sectioned low-, high- and band-pass filters of 'constant k' form, terminated in the design resistance. The 'unit current' method is used, and it is shown that with proper choice of the frequency variable K, the expressions for L and B are functions of K identical for all three types of filter. The values of L and B at cut-off frequencies are given and the general behaviour of these quantities with respect to K is tabulated. Values of L are plotted as a function of K for filters containing up to five sections and compared with an experimental curve for a five-section low-pass filter. Phase shift curves for one-, two- and four-section filters are also shown. Two methods of examining the effects of dissipation in the filter are considered. The preferred method assumes that all inductor and capacitor elements have equal dissipation factors, and gives the dissipation at any frequency at which the slope of the phase shift characteristic is known.

621.392.52.094 **1698**

Distortion of Frequency-Modulated Signals by Band-Pass Filters.—P. Güttinger. (*Brown Boveri Mitt.*, Aug. 1946, Vol 33, No. 8, pp. 185–187.) Quasi-stationary methods are applied to the calculation of the distortion due to passage through two-stage band-pass filters. A practical formula is given for the noise factor.

621.394.652 : 621.394.141 **1699**

The Electroplex—a New Automatic Key.—J. T. Dixon. (*Radio News*, Jan. 1947, Vol. 37, No. 1, pp. 38–39..151.) A system comprising a timing circuit, control circuit, a.f. monitoring oscillator and power supply enabling dots and dashes of a given length to be formed automatically for radiotelegraphy.

621.396.611.1 + 534.112 **1700**

Self-Maintenance of Several Oscillations on the Same Wire.—Jouty & Rocard. (*See* 1728.)

621.396.611.1 **1701**

Duality of the Mechanisms of Self-Oscillation.—Y. Rocard. (*C. R. Acad. Sci., Paris*, 23rd March 1942, Vol. 214, No. 12, pp. 601–603.) The introduction of a negative resistance into an oscillatory circuit is not the only means of producing self-oscillation. An alternative process is termed "confusion of the two natural frequencies". An example is that of two resonating circuits coupled by mutual induction. The voltage at the terminals of the second circuit capacitor feeds an amplifier which, through a very small resistance, supplies in the first circuit an e.m.f. in proportion but in opposition. Self-oscillation is obtained in this case by adjustment of the amplifier gain.

621.396.611.1 : 621.396.619 : 621.395.625 **1702**

Resonant Circuit Modulator for Broad Band Acoustic Measurements.—G. F. Hull, Jr. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1066–1075.) The theory is outlined and an experimental recorder described having a uniform response between 0.5 and 1 000 c/s. Apart from a 5-db resonance peak at 7 500 c/s, the response between 0.025 and 10 000 c/s is constant to within ± 3 db.

621.396.611.1.013.62 **1703**

On Self-Excitation of Electric Systems with Distributed Parameters.—S. Gvosdover. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 5, pp. 481–488.) Formulae are derived for determining the conditions for self-excitation and the amplitude and frequency of the steady state oscillations in terms of the constants of the system.

621.396.611.21 : 621.396.615.029.5 **1704**

Crystal-V.F.O. Mixing.—W. A. Sparks. (*Short Wave Mag.*, Nov. 1946, Vol. 4, No. 9, pp. 554–555.) Details of a circuit for mixing the output of a 6 040 kc/s crystal oscillator with that of a variable frequency oscillator covering the range 1 000–1 500 kc/s to obtain a variable frequency in the range 7 040–7 540 kc/s.

621.396.611.21 : 621.396.62 **1705**

Receiver with Automatic Tuning and Quartz Control.—Martin. (*See* 1912.)

621.396.611.4 **1706**

Resonant Frequencies of the Nosed-In Cavity.—E. Mayer. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1046–1055.) The resonant frequency of a cylindrical cavity with a smaller coaxial re-entrant cavity at one end is studied theoretically using the Ritz variational method. Results on an experimental model differed from theoretical values by about 2.5%, because a slight departure from the theoretical shape was necessary for tuning purposes. Results for several sets of parameters are shown graphically.

621.396.611.4 : 535.214 **1707**

Perturbations and Radiation Pressure in Electromagnetic Cavities.—T. Kahan. (*C. R. Acad. Sci., Paris*, 13th Nov. 1946, Vol. 223, No. 20, pp. 785–786.) From the formulae previously given (2521 of 1946) the perturbed natural frequency of a circular cylindrical cavity is calculated. The general expression is used to find the effect of inserting axially a small metal piston and also the radiation pressure exerted on a small metal diaphragm placed coaxially at the centre of the cavity.

621.396.611.4 : 621.384.6 **1708**

The Study of a Certain Type of Resonant Cavity and Its Application to a Charged Particle Accelerator.—E. S. Akeley. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1056–1060.) A linear accelerator consisting of a number of cavity resonators placed end to end, with the inside end plates removed, is discussed. To determine possible shapes for each cavity, the stationary TM_{01} modes between two parallel plates are found. When only one mode is excited, the radius of the cavity becomes infinite at the plates when the phase velocity is less than that of light. By exciting simultaneously two modes having suitable relative amplitudes, the radius can be made finite everywhere.

621.396.615.029.5 **1709**

H.F. Beat-Frequency Oscillator.—R. Lemas. (*Radio en France*, 1947, No. 1, pp. 4–8.) An oscillator on a fixed frequency F_1, which may be modulated either in amplitude or frequency, is coupled to the grid g_1 of a mixer and a second c.w. oscillator, of variable frequency F_2, is coupled to the grid g_3 of the mixer. The difference frequency F_2–F_1 is selected and its voltage measured by a valve voltmeter. The amplitude of the output is directly proportional to the amplitude applied to g_1, which is controlled by an attenuator. Details of a five-range instrument are given.

621.396.615.17
621.317.39 : 531.76 **1710**

Some Precision Circuit Techniques used in Wave-Form Generation and Time Measurement.—B. Chance. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 396–415.) An outline of the characteristics and uses of nonlinear circuit elements in systems developed for distance measurement, computation and timing in radar circuits. The generation of sinusoidal and other waveforms is described, with diagrams of the circuits employed, and the development of electronic switch circuits for modulation and demodulation of rapidly varying waveforms is discussed.

621.396.615.17 : 621.317.755 **1711**

A Linear Time Base of Wide Range.—D. F. Gibbs & W. A. H. Rushton. (*J. sci. Instrum.*, Nov. 1946, Vol. 23, No. 11, pp. 270–271.) Circuit details for an oscillograph timebase having sweep times from 0.6 ms to 60 sec and delivering a sweep voltage of 350 V. The timebase can also be set for single sweeps.

621.396.619.13 **1712**

Frequency Modulator.—Bruck. (*See* 1960.)

621.396.645 **1713**

A Stabilized 813 Amplifier.—R. M. Smith. (*QST*, Feb. 1947, Vol. 31, No. 2, pp. 23–27, 128.) Uses an 813 beam tetrode with neutralization. Readjustment of the neutralizing capacitor is not necessary when changing frequency bands.

621.396.645 : 535.215 **1714**

Amplification of Very Feeble Photoelectric Currents.—A. Blanc-Lapierre. (*C. R. Acad. Sci., Paris*, 30th March 1942, Vol. 214, No. 13, pp. 660–662.) A brief discussion of various methods.

621.396.645.029.3 **1715**

High-Impedance Input Circuits for A.-F. Service.—C. A. Parry. (*Proc. Instn Radio Engrs, Aust.*, Dec. 1940, Vol. 4, No. 5, pp. 73–75.) The effects of an unbypassed cathode resistor on the input impedance of an RC amplifier are analysed and formulae derived. Noise voltages developed in the resistor and methods of neutralizing hum pickup are discussed.

621.396.645.36 **1716**

150 Watts Push-Pull.—L. H. Thomas. (*Short Wave Mag.*, Dec. 1946, Vol. 4, No. 10, pp. 598–602.) Construction and operational details of a power amplifier of simple design, using pentode valves, for the 14 and 28 Mc/s amateur bands.

621.396.645.37.012.3 **1717**

Three Feedback Amplifier Charts.—J. S. Wells. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1946, Vol. 7, No. 11, pp. 4–7.) These give the gain, phase shift and improvement in gain stability with feedback, as functions of A for various values of θ, A being the magnitude and θ the phase angle of the gain from the input to the feedback terminals.

621.396.662.21.076.2 **1718**

Coaxial Coils for F.M. Permeability Tuners.—W. J. Polydoroff. (*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, pp. 9–10..32.) Requirements of coil design and windings for adaptation of permeability tuning to the new f.m. band.

621.396.662.3 : 621.392.029.64 **1719**

Filtering of Guided Waves.—Ortusi. (*See* 1673.)

621.396.662.34 **1720**

On the Extension of Band-Pass Effect at High Frequencies.—Miss Rajeswari & S. P. Chakravarti. (*Electrotechnics*, Dec. 1946, No. 19, pp. 52–63.) For h.f. wave-filters terminated in thermionic negative impedances. See also 1721 below.

621.396.662.34 : 621.396.611.21 **1721**

On Calculations relating to Band-Pass Effect in Crystal Resonator associated with Thermionic Negative Impedance Element.—S. P. Chakravarti & Miss Rajeswari. (*Electrotechnics*, Dec. 1946, No. 19, pp. 32–40.) The series and parallel connexions of crystal and thermionic element in both the tuned and the detuned conditions are considered theoretically. Previous experimental results are confirmed (1032 and 3267 of 1941 and back references, and 1720 above).

621.396.665 : 518.4 **1722**

A.V.C. Calculations : Graphical Methods of estimating the Performance of Circuits.—S. W. Amos. (*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 46–50.)

621.396.69 + 621.396.621 **1723**

New Methods of Radio Production.—Sargrove. (*See* 1913.)

621.396.69 **1724**

Midget Electronic Equipment.—F.R. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 84–89.) Design data, available types of components and possible applications are given for equipment small enough to be carried in a suit pocket.

621.392.52 + [548.0 : 538.3 **1725**

Wave Propagation in Periodic Structures: Electric Filters and Crystal Lattices. [Book Review]—Brillouin. (*See* 1907.)

621.396.611.4.029.62 **1726**

Der Frequenzstabile Schwingtopf-Generator. [Thesis]—A. Braun. Verlag A. G. Gebr. Leemann, Zürich, 79 pp., 7.50 Swiss francs. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, p. 64.) " It deals with the use of a cavity resonator as the oscillatory circuit of a valve oscillator at frequencies of about 200 Mc/s, with special reference to the constancy of frequency and to the optimum design of the cavity resonator."

GENERAL PHYSICS

531.18 : 531.15 **1727**

Is Rotation Relative or Absolute ?—P. M. C. Lacey. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, p. 63.) Further correspondence on 3564 of 1946 (G.W.O.H.). See also 390 of February.

534.112 + 621.396.611.1 **1728**

Self-Maintenance of Several Oscillations on the Same Wire.—R. Jouty & Y. Rocard. (*Rev. sci., Paris*, 15th Sept. 1946, Vol. 84, No. 3257, pp. 283–285.) A steel wire can be made to oscillate at several widely different frequencies simultaneously by means of an electromagnet whose coil is connected to an amplifier, the output from which passes through the wire. Frequency ratios of about 1 to 10 can be obtained, the higher frequency not being an exact harmonic of the lower. This result differs from van der Pol's for two coupled tuned circuits made self-oscillating by a triode, in which case gradual transfer from one natural frequency to the other was possible, but not simultaneous excitation of both.

534.756 + 621.39 **1729**

Theory of Communication.—D. Gabor. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, p. 58.) Summary of 1057 of April.

535.23.08 + 621.317.794 **1730**

The Production of Film Type Bolometers with Rapid Response.—C. B. Aiken, W. H. Carter, Jr, & F. S. Phillips. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 377–385.) The construction is described of small, rapid-response bolometers consisting basically of a thin gold strip and blackening material deposited successively by evaporation on a cellulose nitrate film. Methods of testing during construction for noise and sensitivity are explained and it is shown that results are improved by the use of metal back plates and a gas pressure of 20 mm of nitrogen.

535.338 **1731**

The Molecular Beam Magnetic Resonance Method. The Radiofrequency Spectra of Atoms and Molecules.—J. B. M. Kellogg & S. Millman. (*Rev. mod. Phys.*, July 1946, Vol. 18, No. 3, pp. 323–352.)

535.343.4 : 538.56.029.64 **1732**

Rotational Spectra of Some Linear Molecules near 1-cm Wave-Length.—C. H. Townes, A. N. Holden & F. R. Merritt. (*Phys. Rev.*, 1st Jan. 1947, Vol. 71, No. 1, p. 64.) A technique is used similar to that noted in 1399 of May for ammonia. Measured frequencies and intensities of lines are tabulated for BrCN, ClCN, and OCS, and moments of inertia and nuclear bond distances are computed. The structure of these molecules is discussed in the light of the results obtained.

537 + 538].081 **1733**

Dimensions and Units of Electromagnetic Quantities.—G. J. Baker. (*Geophys.*, July 1946, Vol. 11, No. 3, pp. 373–384.) A historical discussion, with a conversion table for various systems. The adoption of the m.k.s. system of electromagnetic units by physicists and engineers is urged.

537.122 **1734**

The Characteristics of the Electron.—H. Ebrall. (*Proc. Instn Radio Engrs, Aust.*, April 1944, Vol. 5, No. 4, pp. 3-11.) A historical survey including brief reviews of quantum theory, work function, photoelectric and thermionic emission, shot effect and filament materials.

537.122 : 530.12 **1735**

The Motional Mass of the Electron.—C. A. Boddie. (*Elect. Engng, N.Y.*, Jan. 1947, Vol. 66, No. 1, pp. 45–60.) The interaction of a moving electron and a deflecting electric field is reconsidered *ab initio*. An electric field is shown to have lateral inertia and elasticity as well as the well-known longitudinal tension and lateral pressure ; a velocity of propagation identical with the velocity of light is deduced. The observed change in the ratio of electron charge to mass, previously attributed to change in mass, is shown to be due to a motional effect of the electron in the deflecting electric field ; electron mass is independent of velocity. The kinetic energy acquired by an electron accelerated in an electric field is very much less than the product of charge and potential, owing to the reduction in pull on an accelerated electron with increase in velocity. No practical advantage is to be gained by using potentials over 2 MV for electron acceleration.

537.133 : [546.217+546.621 **1736**

Theoretical Range-Energy Values for Protons in Air and Aluminum.—J. H. Smith. (*Phys. Rev.*, 1st Jan. 1947, Vol. 71, No. 1, pp. 32–33.) Range-energy values are tabulated for energies up to 10^4 MeV. For the theoretical derivation of the formula used see for example 1303 of 1943 (Rossi & Greisen) : restrictions on its validity and computational procedure are discussed.

537·311·31+537·311·33 **1737**

Thermomagnetic Nernst Effect in Semiconductors and Metals.—Pisarenko. (*See* 1815.)

537·311·33 **1738**

Mechanism of Luminescence of Alkali-Halogen Phosphors.—Antonov-Romanovskij. (*See* 1817.)

537·311·37 : 537·525 **1739**

Conductivity of Gases excited by H.F. Discharges.—P. Mesnage. (*C. R. Acad. Sci., Paris*, 8th April 1942, Vol. 214, No. 14, pp. 702–704.) Measurements at about 25 Mc/s give conductivities of 0.03–0.3 mho/cm for hydrogen, 0.2–0.4 mho/cm or more for neon and still higher values for a mixture of argon and cadmium vapour, the pressures being a few tenths of 1 mm Hg. The volt-ampere characteristics are of the descending type, as with arcs.

537·523·4 **1740**

Influence of Electric Fields on the Extinction of Electric Sparks.—O. Yadoff. (*C. R. Acad. Sci., Paris*, 8th July 1946, Vol. 223, No. 2, pp. 74–75.) Application of a radial electric field between a cylinder and the axial path of sparks maintained between two Pt-Ir points has the effect of progressively reducing the brightness of the sparks as the field intensity is increased, until finally the sparks are completely extinguished. For sparks 10 cm long maintained by 51 kV the critical extinction voltage for the cylinder was 264 kV. Reduction of the air pressure increased the extinction voltage. Application is envisaged to high-voltage circuit breakers.

537·533 : 537·311·31 **1741**

Cold Emission from Plane Metallic Surfaces.—F. Bertein. (*C. R. Acad. Sci., Paris*, 23rd Sept. 1946, Vol. 223, No. 13, pp. 475–478.) Comparison of the cold emission current I from a nearly plane surface S with I_0, that from the geometrically plane surface obtained by projecting S on to its mean plane, shows that there may be a considerable discrepancy, so that determination of the characteristic constant A, in Fowler and Nordheim's formula, from the curve relating I and the applied voltage, gives results which are too high. This does not apply to the constant B, which is found from the slope of the curve, which is practically the same for I and I_0. The case of microscopically rough surfaces is also discussed.

537·535·75 **1742**

Absorption of Secondary Electrons by Thin Screens.—A. Saulnier. (*C. R. Acad. Sci., Paris*, 8th April 1946, Vol. 222, No. 15, pp. 876–878.) Secondary X rays from a sheet of lead 0.2 mm thick are used with a graded series of foils of aluminium or cellophane to obtain photometrically a set of curves connecting foil thickness, photographic density and primary X-ray voltage.

538.12 **1743**

Note on Magnetic Energy.—G. H. Livens. (*Phys. Rev.*, 1st Jan. 1947, Vol. 71, No. 1, pp. 58–63.) Reply to a recent article by E. A. Guggenheim (1227 of 1946) referring to the author's earlier work (2825 of 1945) and continuing the discussion of the correct formulation of the Lagrangian and Hamiltonian functions for a system of linear currents and permanent magnetization.

538.23 **1744**

Calculation of the Coercive Field from the Theories of Becker and of Kersten.—L. Néel. (*C. R. Acad. Sci., Paris*, 17th July 1946, Vol. 223, No. 3, pp. 141–142.)

538.323 **1745**

The Force exerted by a Rectilinear Current on a Parallel Current.—É. Brylinski. (*C. R. Acad. Sci., Paris*, 16th Sept. 1946, Vol. 223, No. 12, pp. 453–455.) A supplement to 1747 below. The force between two parallel conductors carrying current is calculated rigorously, including the effects of the finite cross-section of the conductors and their internal permeability. The formulae provide a solid foundation for an absolute definition of the ampere in the m.k.s. system.

538.23 **1746**

Mathematical Representation of Hysteresis Cycles.—P. Bricout. (*Rev. gén. Élect.*, June 1945, Vol. 54, No. 6, pp. 183–191.) A mathematical relation between the magnetizing field and the induction is derived by means of an ' indicator curve ' whose abscissae are inductions and whose ordinates are the logarithms of the slopes of the tangents to the cyclic curve. From the shape of the ' indicator curve ' a representative function can be derived easily, which contains in general a hyperbolic term, an exponential term, and an added constant. The errors due to the use of this function are within those of experimental measurement.

538.31 **1747**

The Force exerted by a Magnetic Field on an Element of Current.—É. Brylinski. (*C. R. Acad. Sci., Paris*, 26th Aug. 1946, Vol. 223, No. 9, pp. 378–380.) A demonstration, by a new argument, that the permeability which figures in the classical formula for the force exerted by a magnetic induction field on a current element is that of the medium and not that of the conductor. See also 1745 above.

548.0 : 547.476.3-162 **1748**

Structure and Thermal Properties associated with Some Hydrogen Bonds in Crystals : Part 7—Behaviour of KH_2PO_4 and KH_2AsO_4 on Cooling.—A. R. Ubbelohde & I. Woodward. (*Proc. roy. Soc. A*, 11th Feb. 1947, Vol. 188, No. 1014, pp. 358–371.) Part 6 was noted in 3256 of 1946.

537·53 : 535·42 **1749**

The Diffraction of X Rays and Electrons by Free Molecules. [Book Review]—M. H. Pirenne. Cambridge University Press, 1946, 160 pp., 12s. 6d. (*Nature, Lond.*, 11th Jan. 1947, Vol. 159, No. 4028, pp. 45–46.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **1750**

Induction of Fast Charged Particles Currents by Rotating Magnetized Cosmic Bodies.—J. Terletzky. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 4, pp. 377–382.) Computation of the motion of charged particles in the electromagnetic field of a rotating magnetized cosmic body whose magnetic and geographic poles do not coincide. The energy up to which the particles can be accelerated in such a field is calculated.

523.165 + 550.37 + 550.38 + 551.510.535] : 061.6 **1751**

Summary of the Year's Work, to June 30, 1946, Department of Terrestrial Magnetism, Carnegie Institution of Washington.—J. A. Fleming. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 517–529.) An account of investigations completed or in progress, with Prof. S. Chapman's comments on the programme. Items are described under the following headings: geomagnetic investigations, cosmic relations, terrestrial electricity, ionosphere, nuclear physics, and observatory and field work. A review of war applications is given and the more important achievements of the various service departments are listed.

523.5 : 621.396.82 **1752**

Radar Detection of Meteor Trails.—E. V. Appleton & R. Naismith. (*Nature, Lond.*, 28th Dec. 1946, Vol. 158, No. 4026, pp. 936–938.) The diurnal and seasonal variation of transient radio echoes from the upper atmosphere have been observed since 1932, and have been ascribed to the incidence of sporadic meteors. Normally, a few tens of these echoes are observed in the evening, rising to a hundred or more in the early morning. On the night of 9th–10th Oct. 1946, their number rose sharply to about 1 500 for a short period at the time of the Giacobinid meteor shower. Though visual observation was impossible on this occasion, the shape of the curve giving rate of echo occurrence agrees remarkably well with that obtained visually by F. G. Watson during the last Giacobinid shower in 1933. It is concluded that the meteoric origin of these transient radio echoes is established.

523.5 : 621.396.82 **1753**

Meeting of the Royal Astronomical Society: Observations of the Giacobinids, 1946.—(*Observatory*, Feb. 1947, Vol. 67, No. 836, pp. 1–8.) The minutes of a meeting of the Society held on 13th Dec. 1946, which included the description and discussion of visual observations of the 1946 Giacobinid shower by J. P. M. Prentice and radio observations by A. C. B. Lovell and J. S. Hey. The ionization density and velocity of the meteor trails were deduced by radar methods. The values obtained—particle radii 0.01–0.03 cm and average velocity 22.9 km/s—are in good agreement with other evidence.

523.7 + 550.385] "1946" **1754**

Magnetic Storms and Solar Activity 1946.—H. W. Newton. (*Observatory*, Feb. 1947, Vol. 67, No. 836, pp. 37–39.) Outstanding solar phenomena in 1946 were the largest and second largest sunspots ever recorded at Greenwich (in February and July) with associated brilliant flares and the highest prominence ever observed. The correlation of this activity with radio fade-out and magnetic storms is demonstrated.

523.7 + 550.385] "1946.07/.09" **1755**

Solar and Magnetic Data, July to September, 1946, Mount Wilson Observatory.—S. B. Nicholson & E. S. Mulders. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 561–562.)

523.7 **1756**

On the Distribution of the Solar General Magnetic Field and Remarks concerning the Geomagnetism and the Solar Rotation.—C. Walén. (*Ark. Mat. Astr. Fys.*, 6th Feb. 1947, Vol. 33, Part 3, Section A, No. 18, 63 pp. In English.) A general mathematical paper. The convective motions in the core are studied in section 2 without any regard to magnetism. Although certain 'convective convulsions' are shown to exist, only a qualitative demonstration of convection within the core is given. The magnetic field in the core is studied in section 3. Calculations are difficult but the conclusion that the general field in the core is reproduced by the convection is, at any rate, certain. The rotation of the sun is discussed in section 4 together with the elastic torsional vibrations resulting from the recurrent 'convulsions'. The conditions at the solar surface (non-uniform rotation, sunspots and the corona) are tentatively discussed. Concluding sections of the paper deal with the general magnetic field in the radiative envelope and with the electric drift-current in the granulated layer.

523.72 + 537.591] : 621.396.822.029.5 **1757**

Radio-Frequency Investigations of Astronomical Interest.—G. Reber & J. L. Greenstein. (*Observatory*, Feb. 1947, Vol. 67, No. 836, pp. 15–26.) Critical survey of the experimental and theoretical work on cosmic and solar radiations at r.f. The dependence of cosmic noise intensity on frequency and on galactic coordinates and the mechanism of its production are discussed, but on present evidence it cannot be decided whether interstellar particles or the stars themselves are the radiant sources. The abnormally intense solar radiation at $\lambda > 1$ m originates in the corona and the frequency dependence is determined by the variation of absorption and temperature with height. The marked increase (1 000 times) of intensity during periods of sunspot activity may be related to gyromagnetic effects caused by the field of the sunspot.

523.72 : 621.396.822 **1758**

On Radio-Frequency Emission from the Sun.—J. V. Garwick. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 551–553.) Discussion based on the gyromagnetic theory of solar radio-frequency emission shows that for the observed radiation the Döppler effect is of little importance. The radiation intensity was previously found to be proportional to H[illegible]. A revised value of the index is 0.9.

523.72 : 621.396.822.029.62 **1759**

Study of the Conditions of Emission of Metre Radio Waves by the Solar Atmosphere.—J. Denisse. (*Rev. sci., Paris*, 15th Sept. 1946, Vol. 84, No. 3257, pp. 259–262.) The possible emission of short waves by electrons moving in the magnetic field of a sunspot is considered. As the waves are absorbed by the very medium which produces them, it is suggested that a layer of thickness z_0 is solely responsible for the emission. In the lower corona z_0 is of the order of several kilometres for a magnetic field of 1 000 gauss, corresponding to a wavelength of 10 cm. Such waves could only emerge if there is a considerable gradient of the magnetic field in the layer of thickness z_0: during the growth of a sunspot, high field gradients appear to be possible. The waves could be transmitted through the corona if generated in its lowest layers, where there is strong emission and feeble absorption. At the surface of the earth it is calculated that a radiation of about 10^{-16} W/cm^2 per megacycle of bandwidth should be obtained for wavelengths from several centimetres to several metres.

523.72 : 621.396.822.029.63 **1760**

Solar Radiation at 480 Mc/s.—G. Reber. (*Nature, Lond.*, 28th Dec. 1946, Vol. 158, No. 4026, p. 945.) Discussion of results of daily automatic recording at Wheaton, Illinois. During a partial eclipse the intensity decreased and variable activity was observed during a radio storm.

523.746 : 538.12 **1761**

Magnetic Field of Sunspots : Part 1.—L. Gurevich & A. Lebedinsky. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 4, pp. 327–332.) The magnetic field of sunspots is explained in terms of a self-excitation process related to the hydrodynamic circulation inside a sunspot. Calculations on this hypothesis give fields of several thousand gauss in the outer layers of sunspots and also show that the magnetic fields in the components of bipolar groups of sunspots are oppositely directed.

523.746 " 1946.07/.09 " **1762**

Provisional Sunspot-Numbers for July to September, 1946.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, p. 500.)

537.591 + 523.165 **1763**

Measurements of the Absorption of Cosmic Rays at an Altitude of 3 050 m above Sea Level.—A. Alichanian & A. Weissenberg. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 293–294.) Continuation of work described in 73 of 1946 (Alichanow & Alichanian). Of two drops observed in the absorption curve one is attributed to the probable presence of protons in the soft component ; the other is as yet unexplained. See also 1423 of May.

537.591 + 523.165 **1764**

On Narrow Showers.—A. Alichanian & A. Alexandrian. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, pp. 296–297.) From an investigation of cosmic ray showers at heights of 960 m and 3 250 m it is concluded that there exist : (*a*) Auger showers of radius about 100 m, (*b*) narrow showers of radius about 50 cm, the radius decreasing with increase of altitude, and (*c*) dense penetrating showers of undetermined radius.

537.591 **1765**

Highly Ionizing Particles in the Cosmic Radiation.—W. Wechsler, N. Dobrotin & V. Khvoles. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 7, pp. 553-556. In Russian, with English summary.) At an altitude of 3 860 m the number of particles with ionizing power 3–4 times that of fast mesotrons was found to be less than 0.5% of the total of penetrating particles. For English version see *J. Phys., U.S.S.R.*, 1945, Vol. 9, p. 277.

537.591 **1766**

On the Space Correlation of Particles in Cosmic Rays : Part 2 — Correlation between Electrons and Photons.—V. Berestetzky. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 8, pp. 665–671.) English version noted in 1435 of May.

537.591.15 **1767**

Ionization Bursts created by Mesotrons.—S. Belenky. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 465–473. In Russian, with English summary.) "Bursts created by δ-electrons due to mesotrons are considered. The spectrum of mesotrons is taken into account. The expression obtained in this way for the number of bursts differs considerably from that given by other authors." English version in *J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 2, pp. 144–150.

537.591.5 **1768**

Variation with Altitude of the Cosmic Ray Showers. Photons in the Showers.—S. Gorodetzky, P. Chanson & H. Denamur. (*C. R. Acad. Sci., Paris*, 16th Feb. 1942, Vol. 214, No. 7, pp. 310–312.)

550.38 " 1946.01/.03 " **1769**

Five International Quiet and Disturbed Days for January to March, 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, p. 560.)

550.38 " 1946.07/.09 " **1770**

American Magnetic Character-Figure, C_A, Three-Hour-Range Indices, K, and Mean K-Indices, K_A, for July to September, 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 505–508.)

550.384 **1771**

Periodicity of Geomagnetic Activity.—A. Ogg. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 543–546.) The results are given of a harmonic analysis of three-hour-range magnetic indices at Hermanus from 1940 to 1946. Periods of magnetic activity which were half and one-third of the solar rotation period were found, in addition to the full period of 26.875 days.

550.385 " 1946.09 " **1772**

Geomagnetic Disturbance of September 16–23 [1946].—(*Nature, Lond.*, 5th Oct. 1946, Vol. 158, No. 4014, pp. 477–478.) A description of the geomagnetic and associated phenomena of the disturbance, which coincided with marked sunspot activity. At Abinger the extreme ranges were 2° 16′ in D, 925γ in H and 450γ in V. A short radio fade-out was reported during the storm and during this fade-out a small solar flare was observed at Greenwich. Reprinted in *Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 577–578.

551.508.1 : 621.396.9 **1773**

The British Radio-Sonde.—P. A. Sheppard. (*Quart. J. R. met. Soc.*, April/July 1946, Vol. 72, Nos. 312/313, pp. 169–173.) A description is given of the apparatus and procedure used, and the magnitude of errors in measurement is discussed. Report of a discussion at a Royal Meteorological Society meeting. For the original account of the apparatus see 4263 of 1938 (Thomas).

551.510.535 + 621.396.812 **1774**

Echoes on Short Waves at Low Altitude.—R. Jouaust. (*C. R. Acad. Sci., Paris*, 16th Feb. 1942, Vol. 214, No. 7, pp. 309–310.) During the daily ionosphere measurements carried out in Paris about midday in 1938 and 1939, echoes were observed at altitudes lower than that of the E layer. Comparison with records of abnormal long-wave (11 000 m) propagation between Paris and Casablanca and Tunis, shows that on three occasions when the short-wave echoes were sharpest, almost simultaneous strengthening of the 11 000 m signals occurred. The observed heights of the reflecting layer were of the order of 70 to 100 km.

551.510.535 **1775**

Early History of the Ionosphere.—A. L. Green.

(*A.W.A. tech. Rev.*, Dec. 1946, Vol. 7, No. 2, pp. 177–228.) A detailed survey, with extensive bibliography, of early work on the ionosphere.

551.510.535 **1776**

The Origins of the E Layer of the Ionosphere.—R. Jouaust. (*C. R. Acad. Sci., Paris*, 2nd March 1942, Vol. 214, No. 9, pp. 441–442.) Ionization in the E layer is shown to be due not to normal atoms, but to atoms excited to a metastable state. Study of the light from the night sky leads to the conclusion that certain metastable atoms should exist at a height of about 100 km and these can be excited by radiation of wavelength 1 323 Å. The mechanism proposed by Cabannes and Aynard to explain the production of these atoms also explains the low altitude of the E layer.

551.510.535 : 523.78 (485) " 1945.07 " **1777**

Chalmers Solar Eclipse Ionospheric Expedition 1945.—O. E. H. Rydbeck. (*Chalmers tekn. Högsk. Handl.*, 1946, No. 53, 44 pp. In English.) Observations were made for a month, centred on 9th July 1945 the day of the eclipse, near Umeå in northern Sweden. Effects in the E and F_1 layers were regular and symmetrical: apparent recombination coefficients were $\alpha_E = 1.1 \times 10^{-8}$ for the E layer and $\alpha_{F_1} = 0.6 \times 10^{-8}$ for the F_1 layer. The electron-density/time curves for the E and F_1 layers during the eclipse period had practically the same shape and gave a ratio of recombination coefficients equal to 1.8. Calculations on the basis of constant α-values indicate that the ionizing radiation from the corona cannot be neglected. The results of the observations agree with those of previous workers and add further proof to the theory that the primary ionizing force of the E and F_1 layers is ultra-violet light from the sun.

F_2-layer results were more complex. The recombination coefficient α_{F_2} was of the order of 3×10^{-9}; there was a definite ultra-violet light eclipse effect, and there may be an eclipse temperature effect resulting in a contraction of the layer. No definite indications of a corpuscular eclipse were noticed. High latitude F_2 eclipse effects seem to show a definite character which differs from that observed in equatorial regions; this may be due to geomagnetic control.

The paper includes a general theoretical discussion of eclipse effects upon the time-variation of ionospheric electron densities. Simple formulae have been obtained for the calculation of E and F_1 minimum solar eclipse electron densities; these formulae can be used for rapid determination of the recombination coefficient.

The influence of horizontal diffusion upon the F_2 eclipse electron density variation is also discussed theoretically and is shown to be unimportant even in regions of high electron temperature.

551.510.535 : 523.78(485) " 1945.07.09 " **1778**

Records of the Ionosphere during the Total Eclipse in the North of Sweden on July 9, 1945.—W. Stoffregen. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 495–499.) Measurements made with a portable automatic recorder showed variations of ionization nearly symmetrical with respect to the eclipse, and agreeing with earlier observations. The F_2 region showed a marked increase in height, while towards the end of the eclipse the abnormal-E ionization disappeared.

551.510.535 : 621.396.812 **1779**

Radio Waves and the Ionosphere.—G. W. O. Howe. (*J. Brit. Instn Radio Engrs*, Jan./Feb. 1947, Vol. 7, No. 1, pp. 36–42.) A short historical survey is followed by a discussion of the mechanism which causes radio waves entering the ionosphere to return to the earth. Reference is made to experimental results by Appleton and others.

551.594 : 546.212-14/-16 **1780**

Electrical Effects associated with a Change of State of Water.—J. E. Dinger & R. Gunn. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 477–494.) A laboratory investigation shows that freezing and melting give rise to changes in contact potential at the air-water interface. The results are of interest in explaining the charges on atmospheric precipitation and the separation of electricity in clouds.

551.594.11(65) **1781**

A Year's Records of the Atmospheric Electric Potential Gradient at Tamanrasset (Hoggar).—J. Lacaze. (*Rev. sci., Paris*, 15th Sept. 1946, Vol. 84, No. 3257, pp. 286–289.)

551.594.12 **1782**

The Ionisation in the Lowest Regions of the Atmosphere.—J. A. Chalmers. (*Quart. J. R. met. Soc.*, April/July 1946, Vol. 72, Nos. 312/313, pp. 199–205.) Assuming the rate of ionization at the earth's surface to be 5 times that at a height of 1 m, it is possible to obtain a variation of conductivity in general agreement with Hogg's results without requiring a space charge large enough to alter the field appreciably.

551.594.21 **1783**

A Theory of the Fundamental Phenomena of Atmospheric Electricity.—J. Frenkel. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1944, Vol. 8, No. 5, pp. 244–272. In Russian, with English summary.) The principles of colloidal electrochemistry are applied to the thunder-cloud. In the dispersive medium formed by the weakly ionized air, negative electrification of the water drops or ice crystals is deduced.

551.594.221 : 621.396.821 **1784**

The Nature and Variation of Atmospherics caused by Lightning Discharges.—H. Norinder & W. Stoffregen. (*Ark. Mat. Astr. Fys.*, 6th Feb. 1947, Vol. 33, Part 3, Section A, No. 16, 44 pp. In English.) Preliminary report of research in progress. The electric field changes associated with atmospherics and the variation of waveform with distance from the source are examined. Waveforms are photographically recorded by various oscillographic techniques and preliminary discharges have been observed up to 0.5 sec before the main discharge in addition to the usual ' leader ' strokes. Further measurements will be made by taking simultaneous recordings at various distances from the source.

551.594.52(481) " 1911/44 " **1785**

Frequency of 12,330 Measured Heights of Aurora from Southern Norway in the Years 1911-1944.—C. Störmer. (*Terr. Magn. atmos. Elect.*, Dec. 1946, Vol. 51, No. 4, pp. 501–504.)

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 551.594.6 **1786**

Atmospherics and Their Location.—C. Clarke. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, pp. 54–55.) The nature of the discharge process associated with a lightning flash is briefly considered. A direction-finder used for locating lightning flashes must have a selective tuned receiver for an operating band of about 10–30 kc/s, a linear output for a wide range of input voltages, and a higher overall gain than would be necessary for c.w. signals of similar field strength. A c.r.t. with a persistent screen must be used. Brilliance modulation has marked advantages. Atmospherics are located by simultaneous observation of their direction of arrival at two well-separated stations. The main source of inaccuracy is polarization error. Summary of an I.E.E. Students' section paper.

621.396.932 **1787**

Decca Navigator.—(*Wireless World*, Feb. 1947, Vol. 53, No. 2, p. 67.) Now approved by the Ministry of Transport for general marine navigation, after extensive trials.

621.396.932/.933].24 **1788**

Consol.—(*Wireless World*, Feb. 1947, Vol. 53, No. 2, p. 67.) The first Consol d.f. station, situated at Bush Mills, Co. Antrim, Northern Ireland, now provides a 24-hour service for civil aircraft. For a description of the system, see 2912 of 1946 (Clegg).

621.396.933 **1789**

Gee : A Radio Navigational Aid.—R. J. Dippy. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 468–480.) A 'master' station transmits 6-μs pulses at a repetition frequency of 500 per sec; two 'slave' stations also transmit 6-μs pulses at a repetition frequency of 250 per sec, and are locked to the 'master' so that the interval between 'master' and 'slave' pulses remains constant. The signals are displayed on the airborne receiver so that the path difference from the aircraft to the 'master' and each 'slave' station can be read directly. Charts are provided with a system of hyperbolae of constant path difference plotted for the 'master' and each 'slave' station: the aircraft's position is then determined as an intersection of a hyperbola of each system.

The airborne and ground-station equipments are described in detail. A later development was the introduction of a third slave station to give all-round coverage, and the design of light transportable ground stations. Future possibilities of the system are briefly discussed. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 344–345.

621.396.933 **1790**

Oboe : A Precision Ground-Controlled Blind-Bombing System.—F. E. Jones. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 496–511.) Aircraft flying at 30 000 ft could be controlled from two ground stations up to a range of nearly 300 miles. Bombs were released automatically by a signal sent from one of the ground stations; the radial bombing error was of the order of 100 yards, varying with aircraft height, range and speed. The two ground stations transmit pulses on the same carrier frequency but different pulse recurrence frequencies. The tracking station guides the pilot on to a circular track passing over the target while the releasing station determines the ground speed of the aircraft along this track and hence the bomb release point. The airborne and ground station equipments are described in detail. Possible future applications are mentioned. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 345–346.

621.396.933 **1791**

200-Mc/s Radar Interrogator-Beacon Systems.—K. A. Wood. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 481–495.) Extensive war-time use of radar beacon systems is described. Particular problems encountered in developing both ground and airborne equipment are discussed. The development of the i.f.f. identification system is outlined, with the modifications which later made possible its use as a simple navigational aid. The series of equipments known as 'Rebecca-Eureka' enabled aircraft not fitted with radar search equipment to use the beacon system. Aircraft approach and landing by the Beam Approach system are considered. Special developments of the beacon system to meet operational requirements of all three Services are outlined and trends in development for future use are reviewed. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 347–348.

621.396.933.23 **1792**

The C.A.A. Instrument Landing System.—C. E. Planck. (*Inter-Avia*, Nov./Dec. 1946, Vol. 1, Nos. 8/9, pp. 63–66.) The system introduced by the U.S. Civil Aeronautics Administration consists of a runway localizer (110 Mc/s), a straight-line glide path (330 Mc/s) and marker beacons (75 Mc/s). These elements are briefly described, and details and photographs of the ground and airborne equipments are given. Advantages over the G.C.A. radar system are claimed in cheapness and in automatic devices for instrument landing and control tower monitoring.

621.396.96 **1793**

H$_2$S : An Airborne Radar Navigation and Bombing Aid.—C. J. Carter. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 449–467.) A radar device giving a visual plan of the terrain beneath so that accurate navigation and bombing become possible from above clouds. Development of the system since 1939 is traced, and its operational use by the R.A.F. is briefly considered. The functions of the various units which make up the complete equipment are outlined; particular attention is paid to the correction of slant-range distortion to give a true plan position indication, and to problems of display and aerial design peculiar to this equipment. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 343–344.

621.396.96 **1794**

Principles and Applications of Radar.—L. Bouthillon. (*Bull. Soc. franç. Élect.*, Nov. 1946, Vol. 6, No. 63, pp. 563–578.) An outline of the basic principles of radar and of the technique of determining direction and range, together with some military applications.

621.396.96 **1795**

Questions concerning Different Radar Systems.—G. Guanella. (*Inter-Avia*, Nov./Dec. 1946, Vol. 1, Nos. 8/9, pp. 48–54.) Comparison of the short-pulse method and the beat method, in which the transmitter frequency is changed uniformly during a pulse of relatively long duration, shows that theoretically the two methods are comparable in accuracy. The detection of moving objects by Döppler techniques is discussed and the practical embodiment of the various systems is described.

621.396.96 (44) **1796**

French Contributions to Radar.—M. Ponte. (*Bull. Soc. franç. Élect.*, Nov. 1946, Vol. 6, No. 63, pp. 579–588.) A general description of experimental work on the detection of obstacles by ultra short waves, carried out in France between 1934 and 1942. See also 1099 of April and back reference.

621.396.96 : 371.3 : 534.321.9 **1797**

H_2S Trainer.—G. W. A. Dummer. (*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 65–66.) Ultrasonic waves propagated through water on to submerged relief maps enabled H_2S operational conditions to be reproduced on a scale of 1 : 200 000.

621.396.96 : 531.55 **1798**

Naval Fire-Control Radar.—J. F. Coales, H. C. Calpine & D. S. Watson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 349–379.) Development is reviewed from the beginning as a simple range finder to the present accurate and complex form. Aerial arrays are described, with polar diagrams, and the installation of the equipment aboard ships is shown diagrammatically.

Methods of display and the problem of discriminating between targets are discussed. Such narrow beam widths are required, and the actual size of the equipment is so limited by the available space, that very high frequencies are used. The development of equipment in the 600, 3 000 and 10 000 Mc/s bands is described and methods of using radar to locate shell splashes to correct gun laying are explained.

A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 323–325.

621.396.96 : 531.55 **1799**

Precision Ranging Systems for Close-Range Weapons.—H. W. Pout. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 380–394.) The development of close-range sets is described and also the reasons for the successive changes. The prediction of aircraft future position is discussed, including analysis of 'rate aiding' as a method of rate determination. Two sets are described, with block diagrams. The first of these, Type 282, did not give the required accuracy. The second, Type 285 incorporating Panel L22, is described in detail and the problems associated with the use of Panel L22 in conjunction with the auto-barrage unit are discussed. An account is given of a completely self-contained automatic set including auto-ranging and auto-aiming of the guns. The limitations of such a system are outlined. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 326–327.

621.396.96 : 531.55 **1800**

The Application and Design of Medium-Precision Ranging Equipment.—H. A. Prime. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 395–410.) A description of Ranging Outfit R.T.A. for use on small vessels, with diagrams of parts of the circuit. The modified version (Outfit R.T.C.) of this set, used for control of short-range anti-submarine weapons, is also described.

The design of medium-precision ranging equipment for use with p.p.i. display is discussed, reference being made to Ranging Outfit R.T.D., Display Outfit J.P. and the applications of such equipment to torpedo control, navigation and shore bombardment.

The limitations of this type of display led to the development of equipment known as Ranging Outfit R.T.B. which combines a sector display with R.T.A.

A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 327–328.

621.396.96 : 531.55 **1801**

Engineering Design of Ship-Borne Gunnery Radar Panels.—T. C. Finnimore & W. D. Mallinson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 441–447.) The design of radar equipment to operate under the conditions experienced aboard ship is described with particular reference to two types developed during the war. A note on future trends in design is added. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 329–330.

621.396.96 : 531.55 **1802**

Naval Gunnery Radar.—(*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 447–448.) A discussion led by Cmdr. C. G. Mayer, U.S.N.R., on 1798 to 1801 above, and 1803 and 1804 below.

621.396.96 : 531.55 **1803**

Checking the Angular Accuracy of Precision Fire-Control Radar.—G. H. Beeching. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 519–526.) The principal sources of error are incorrect alignment of the mechanical axis of the aerial system and of the electrical axis of the radar equipment, and incorrect installation with respect to predictor, guns, etc. Methods are described for checking and correcting these errors in typical Army equipment.

621.396.96 : 531.55 : 621.396.611.21 **1804**

A Precision-Ranging Equipment using a Crystal Oscillator as a Timing Standard.—C. A. Laws. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 423–440.) A detailed account, with practical difficulties experienced, of the development of a system for naval armament fire-control. One period of the crystal is equal to a radar range of 1 000 yards and the intervals are continuously subdivided by a phase-shifting transformer in the oscillator output, one revolution giving a linear phase-change of 360°, so that it can be calibrated in terms of radar range. The form of display of the radar and timing signals on a cathode-ray tube gives a very high measurement accuracy.

Recent applications of the system are described, with an appendix on the factors governing the phase-shifting transformer accuracy.

A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, pp. 325–326.

621.396.96.004.11 **1805**

Airborne Radar Specifications.—(*Electronics*, Feb.

1947, Vol. 20, No. 2, p. 132.) Brief technical details of various U.S. Army radar equipments recently declassified. Further information can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C.

621.396.96.088.2 **1806**

The Measurement of the Zero Error of Range in Radar Equipments.—H. I. S. Allwood, J. G. Bartlett & G. T. Davies. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 513–518.) A brief description of the precautions necessary for eliminating errors, and details of the measurement of the zero error by means of an electronic calibrator employing an artificial target. Ranges can usually be determined to within ten yards of the true value. A summary of this paper is given in Part IIIA, 1946, Vol. 93, No. 1, p. 127.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.215.6 : 546.281.26 **1807**

A New Spectral Effect and a Method for determining the Long Wave-Length Limit of the Rectifier Photoeffect in Carborundum Monocrystals.—O. V. Losev. (*Bull. Acad. Sci. U.S.S.R., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 494–498. In Russian with English summary.) In the 'active layer' of carborundum monocrystals a special component of the rectifier photoeffect may be observed when an accelerating voltage is applied. The ratio of this component to the short-circuit photocurrent increases steadily if the wavelength of the monochromatic light is decreased. This fact is used for the determination of the long wavelength limit of the rectifier photoeffect.

535.37 **1808**

Luminescence of $(Zn, Be)_2SiO_4$: Mn and Other Manganese-Activated Phosphors.—J. H. Schulman. (*J. appl. Phys.*, Nov. 1946, Vol. 17, No. 11, pp. 902–908.)

535.37 **1809**

Luminescence Extinction in Complex Molecules.—L. A. Tumerman. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, p. 328. In Russian.) Discusses the effect of temperature and the existence of a 'dark pause'.

535.37 : 537.311.33 **1810**

Contemporary Investigations of the Mechanism of Luminescence of Semi-Conductors.—V. L. Levšin [W. L. Lewschin]. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 510–522. In Russian with English summary.) Luminescent solid phosphors can be divided into three groups. The first are activated by complex organic molecules; their absorption and emission spectra are closely connected. Emission consists of a momentary process lasting approximately 5×10^{-9} sec together with an exponential process lasting about 1 sec due to metastable levels of the activator molecules. The second group includes luminescent pure inorganic substances and isomorphic crystals, for which absorption and emission spectra are also closely connected. Luminescence consists essentially of an exponential process lasting about 0.01 sec. The third group includes crystalline phosphors activated by impurities of heavy metals. Emission consists of a momentary process lasting less than 10^{-5} sec, a short exponential process lasting about 0.01 sec and a prolonged hyperbolic recombination process. The momentary process provides a fraction of the total radiation negligible at low intensity, and increasing with intensity. Curves obtained by using a phosphoroscope with a rotating mirror are given, illustrating these processes for ZnS.Mn- and ZnS.Cu-phosphors. Investigation of isotherms of decay shows that the character of the process changes little with temperature in the range 90°–670°K; increase in recombination probability with temperature is compensated by a decrease in the number of excited electrons present when excitation ceases. The character of isotherms taken when the number of electrons remains approximately constant is very sensitive to temperature changes, as are also the light sums accumulated during excitation. From the relationship between light sum and temperature, the energy required to liberate a localized electron can be deduced.

535.37 : 546.65 **1811**

Luminescence of Solutions of Salts of the Rare Earths.—A. N. Zaidel. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 329–334. In Russian.)

535.37 : 548.0 **1812**

The Luminescence of Crystalline Substances.—V. L. Levshin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 355–368. In Russian.) A new scheme to explain the mechanism. Main features are the assumption of three types of discontinuous radiation, and an explanation of the nature of adhesion levels.

535.37 : 666.1 **1813**

Luminescence of Glasses.—V. V. Vargin & T. I. Weinberg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 563–574. In Russian.) Critical survey of existing knowledge.

535.371 **1814**

Some Problems of the Synthesis of Zinc-Sulphide Phosphors with Long Afterglow.—V. M. Gougel. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 539–542. In Russian.) Discusses the effect of impurities on the intensity and colour of the luminescence.

537.311.31 + 537.311.33 **1815**

Thermomagnetic Nernst Effect in Semi-Conductors and Metals.—N. L. Pisarenko. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 417–421. In Russian with English summary.) The magnitude as well as the sign of this effect may be explained by the mode of dependence of the time of the electron free path on the velocity, and by the fact that in semiconductors in which the conductivity is of a complex nature both types of charge carriers are present.

537.311.33 + 621.315.59 **1816**

Experimental Investigation of the Metal-Semiconductor Contact.—V. I. Ljašenko, G. A. Fedorus & S. P. Felvašnikova. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 434–441. In Russian with English summary.) An investigation for cuprous oxide and selenium of the relation between metal-semiconductor contact potential difference and field strength, current density, and conductivity. The potential difference at first increases almost linearly with current density, then attains a maximum, and finally falls to zero. The smaller the conductivity of the specimen, the larger the potential difference.

The explanation suggested is that the flow of current reduces the ' holes ' concentration in the layer of chemically uniform semiconductor near a contact. The experimental data agree fairly well with S. I. Pekar's theoretical results (1819 below).

537·311·33 **1817**

Mechanism of Luminescence of Alkali-Halogen Phosphors.—V. V. Antonov-Romanovskij. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 523–531. In Russian with English summary.) Discussion of decay phenomena leads to the conclusion that the Bloch-Wilson representation of semiconductors, if applied to phosphorescence, must take account of the interaction between the electron and the ionized centre, long before their recombination, and also of the fact that the average displacement of the thermal electron, in the time interval between captures, is relatively small.

537·311·33 **1818**

Electrical Conductivity of Semiconductors in Strong Electric Fields.—B. I. Davydov & I. M. Šmuškevič. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 399–408. In Russian with English summary.) Different mechanisms which may increase the conductivity of semiconductors in strong fields are considered. The magnitude of the field at which these mechanisms become significant is evaluated. The deviations from Ohm's law in the case of a semiconductor with an ionic lattice in a strong field are examined in detail. When solving the kinetic equation, not only the interaction of electrons with the optical vibrations of the lattice, but also inelastic collisions, *i.e.* the ionization, must necessarily be taken into account. In contrast to the semiconductor with an atomic lattice, the mobility of electrons in that with an ionic lattice increases in strong fields. The dependence of the mobility on the field and the temperature has different forms according to whether kT is greater or less than $h\omega_0$, ω_0 being the limiting frequency of optical vibrations of the crystal. The mobility of electrons, the number of ionizing collisions and the resulting concentration of free electrons are found for both limiting cases ; the intermediate case may be interpolated.

537·311·33 **1819**

The Metal-Semiconductor Contact and the Contact Potential Drop.—S. I. Pekar. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 422–433. In Russian with English summary.) A theory of the metal-semiconductor contact is considered which differs from those previously given by Mott and Johnson by taking into account the redistribution of the concentration of conducting electrons in a semiconductor caused by the passage of the current. Contact potential differences and their dependence on current density could thus be calculated. The experimental data of Ljašenko, Fedorus & Felvašnikova (1816 above) confirm the theory.

537·311·33 : 546.281.26 **1820**

On the Mechanism of the Electric Conductivity of Silicon Carbide.—G. Busch & H. Labhart. (*Helv. phys. Acta*, 18th Dec. 1946, Vol. 19, Nos. 6/7, pp. 463–492. In German.)

537·323 : 546.817.221 **1821**

The Thermoelectric Effect in Lead Sulphide.—E. D. Devjatkova, J. P. Maslakovec & M. S. Sominskij. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 409–416. In Russian with English summary.) Theoretical expressions are given for the dependence of thermoelectric force on the concentration of carriers of electricity. The temperature variations of electrical and thermal conductivities and of thermoelectric force are investigated in lead sulphide having electronic as well as ' hole' conductivity. The results obtained show that in lead sulphide the concentration of carriers of electricity equals 10^{18}–10^{19}. The electrical conductivity is determined mainly by the temperature variation of the mobility of the carriers.

538.22 : [669.155 + 669.245.5 **1822**

Magnetic Properties and Chemical Nature of Solid Solutions of Weak Magnetic Elements in Nickel and Iron.—J. Dorfman. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 4, pp. 349–360. In Russian, with English summary.) The nature of the elementary nickel magnet can be understood if numerical results of gyromagnetic investigations are taken into account as well as experimental magnetic data.

The magnetic properties, above the Curie point, of solid solutions of different metals in nickel (at low concentrations of the alloying metal) are determined not only by the valency of the foreign atoms, but also by the individual chemical peculiarities of the elements. The theory of zones is not fully applicable to nickel *d*-electrons.

There is a close analogy between the magnetic properties of nickel and iron alloys, but the peculiar structure and filling of *d*-levels of metallic iron explains some magnetic properties of iron alloys.

The difference between the chemical bonds of ' included atoms ' and ' replacement atoms ' explains why carbon behaves differently from other elements when dissolved in iron.

538.221 **1823**

Time Effects in Materials containing Iron under the Influence of Mechanical and Magnetic Forces.—J. L. Snoek. (*Schweiz. Arch. angew. Wiss. Tech.*, Jan. 1947, Vol. 13, No. 1, pp. 9–14.) A discussion of dispersion and relaxation phenomena, both elastic and magnetic, based on Bloch's theory of magnetism. Long- and short-time after-effects are found, the first concerned with the diffusion of material particles, while the second is as yet unexplained, though possibly connected with the *s*- and *d*-electrons.

546.28 + 621.383.4 **1824**

A New Bridge Photo-Cell employing a Photo-Conductive Effect in Silicon. Some Properties of High Purity Silicon.—Teal, Fisher & Treptow. (*See* 1961.)

549.514.51 **1825**

Growing Quartz Crystals.—(*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, p. 30.) An abstract of " Report of Investigations in European Theater ; PB-28897 " describing a German method in which a seed crystal of quartz is suspended in a mixture of finely ground glass and water and is heated in an autoclave to 375° C.

620.197(213) : 621.396.6 **1826**

Deterioration of Radio Equipment in Damp Tropical Climates and Some Measures of Prevention.—C. P. Healy. (*A. W. A. tech. Rev.*, Dec. 1946, Vol. 7, No. 2, pp. 103–129.) Reprint of 3502 of 1946.

621.3.011.5.029.5/.6] : 631.437 **1827**

Dielectric Properties of Indian Soils at High and Medium Radio-Frequencies.—Khastgir, Ray & Banerjee. (*See* 1900.)

621.315.59 **1828**

Papers on Semiconductors.—(*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 546–554.) Summaries in English and Russian of the following papers are given : A Complex Investigation of the Mechanism of Semi-Conductor's Electrical Conductivity, by V. A. Davidenko. A New Method of Investigating the Electrical Conductivity of Semi-Conductors and Results of Application of this Method to the Investigation of Conductivity of Alundum, by A. R. Šulman. Concentration Phenomena in Semi-Conductors, by B. I. Davydov. Galvanomagnetic Effects in Semi-Conductors, by I. D. Rožanskij. A Contact between a Semi-Conductor and a Metal, by A. V. Ioffe & A. F. Ioffe. Solid Rectifiers, by P. V. Šaravskij. The Investigation of Sulphide Rectifiers, by J. A. Dunajev & B. V. Kurčatov. Inner Photoelectric Effect in Sulphur and Electronic Energy Levels, by P. S. Tartakovsky & G. I. Rekalova. On the Photoelectrically Inactive Absorption of Light by Some Semi-Conductors, by F. F. Volkenštein. Spectral Distribution of Rectifier and Inner Photoeffect in Selenium, by D. I. Arkadiev.

621.315.6 + [621.39 : 371.31 **1829**

The War-Time Education and Training of Radio Personnel and Recent Developments in Dielectric Materials.—Jackson. (*See* 1973.)

621.315.616 : 621.317.33.011.5 **1830**

Dielectric Investigations on Polymeric Fluids.—R. Goldschmidt. (*Schweiz. Arch. angew. Wiss. Tech.*, Jan. 1947, Vol. 13, No. 1, pp. 21–27.) Describes the method of measurement of the permittivity, loss angle, insulation resistance, viscosity and expansion coefficient of oils and various mixtures. The results are given graphically. Photographs show the development, during cooling, of pseudo-crystalline patterns in mixtures of ozocerite and resin.

621.357.8 **1831**

Electropolishing.—C. L. Faust. (*Metal Ind., Lond.*, 20th Dec. 1946, Vol. 69, No. 25, pp. 512–513.) Discusses the status of electropolishing as a metal finishing process.

621.395.625.3 **1832**

Magnetic Tape Recorder.—(*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, p. 7.) Uses a paper tape ¼ inch wide coated with a new metallic paint having magnetic properties that are claimed to approach those of Alnico III.

621.775.7 : 669.3 **1833**

Copper-Base Powder Metallurgy Parts.—H. Chase. (*Materials & Methods*, Dec. 1946, Vol. 24, No. 6, pp. 1439–1444.)

669.14 : 621.396.69 **1834**

A New Radar Transformer Steel.—G. H. Cole & R. S. Burns. (*Materials & Methods*, Dec. 1946, Vol. 24, No. 6, pp. 1457–1460.) A steel, containing 3 to 3.5% silicon, capable of being rolled to a thickness of 0.002 inch, and suitable for radar pulse-transformer laminations.

679.5 : 621.3 **1835**

Plastics in Electrical Industry.—T. J. Fielding. (*Electrician*, 1st–15th Nov. 1946, Vol. 137, Nos. 3570–3572, pp. 1196–1199, 1281–1285 & 1370–1374.) A general account of the properties of various bakelite materials, in laminated forms, as anti-tracking materials, and as resins, varnishes and cements, together with their electrical applications.

679.5 : [621.315.616 + 539.4 **1836**

Standard Tests for Thermosetting Plastics.—(*See* 1865.)

678.02 **1837**

Advances in Colloid Science, Vol. 2. [Book Review]—H. Mark & G. S. Whitby (Eds.). Interscience Publishers Inc., New York, 1946, 453 pp., $7. (*Nature, Lond.*, 28th Dec. 1946, Vol. 158, No. 4026, pp. 924–926.) A much-needed co-ordination of recent developments in rubber science.

MATHEMATICS

517.941.9 : 53 **1838**

A New Method of Solution of Certain Boundary Problems for Equations of Mathematical Physics permitting of a Separation of Variables.—G. Grünberg. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 4, pp. 301–320.)

518.5 **1839**

Concerning " Computer for Solving Linear Simultaneous Equations ".—C. C. Eaglesfield : C. E. Berry. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, p. 1125.) Suggested modifications to the design described in 1927 of 1946 to make it easier and quicker to use, and Berry's reply, stating that the same mathematical method had been suggested several months previously by W. M. Bleakney.

519.283 : 621.318.572 **1840**

On the Distribution of Counts in a Counting Apparatus.—Hole. (*See* 1877.)

530.162 : 621.394/.397].822 **1841**

Study of Fluctuations produced by the Shot Effect in Amplifiers.—A. Blanc-Lapierre. (*Rev. sci., Paris*, June/July 1946, Vol. 84, No. 3254, pp. 75–94.) A review of the analytical methods used for calculating the influence of linear amplifiers and of non-linear detectors on a random voltage. The properties of the correlation function of a random variable are related to its spectral density ; for Bernamont's earlier work on this subject see 1715 of 1937 and back references. The relations between the characteristic function, the probability distribution and moments of a variable are established. In practice the Laplace-Gauss (normal) distribution is valid since the number of elementary events occurring within the time constant of the apparatus is very large, and its general formulation for K variables is derived. The results are applied to the case of detectors having the law $y = x^{2p}$ and to a linear detector (single- or full-wave). The significance of departures from the normal distribution is discussed and it is shown that if an arbitrary fluctuation voltage is applied to an amplifier of large time constant, the small fluctuations appearing at the output depend only on the amplifier and have a normal distribution. Cf. similar work by Fränz (3026 and 3027 of 1941, 2124 of 1943, and 443 of 1944). An abbreviated version of this paper appears in *Bull. Soc. franç. Élect.*, Nov. 1945, Vol. 5, No. 53, pp. 343–351.

518.3 : 621.3.012.3.081.4 **1842**

DB Gain-Loss Calculator.—L. A. Lohr. (*Electronics*, Feb. 1947, Vol. 20, No. 2, p. 134.) An abac for converting ratios to decibels.

MEASUREMENTS AND TEST GEAR

538.569.4 + 621.396.812].029.64 : 551.51 **1843**

Atmospheric Absorption Measurements with a Microwave Radiometer.—R. H. Dicke, R. Beringer, R. L. Kyhl & A. B. Vane. (*Phys. Rev.*, 1st/15th Sept. 1946, Vol. 70, Nos. 5/6, pp. 340–348.) The absorption of microwave radiation in traversing the earth's atmosphere has been measured at wavelengths of 1.0 cm, 1.25 cm, and 1.50 cm in the neighbourhood of a water vapour rotational absorption line. A sensitive radiometer was used to detect thermal radiation from the absorbing atmosphere at these wavelengths. From the measured absorption, together with data from humidity soundings of the atmosphere, absorption coefficients under standard conditions (293°K and 1 015 mb) can be calculated. These are 0.011, 0.026 and 0.014 db per km for 1 gm of water vapour per cubic metre, at wavelengths of 1.00, 1.25 and 1.50 cm respectively.

620.179.1 **1844**

Non-Destructive Testing.—(*Elect. Times*, 30th Jan. 1947, Vol. 111, No. 2884, pp. 147–148.) Summary and discussion of an I.E.E. paper by H. C. Turner and E. M. Tomlin. Special instruments described include (*a*) a magnetic sorting bridge using the change of the hysteresis loop with variations of heat treatment, hardness or depth of carburation, (*b*) a vibration analyser with crystal pickup, (*c*) a crystal resonance apparatus for thickness measurement from one side only and (*d*) a development of (*c*) for the detection of flaws in sheet material.

621.317.31.014.33 **1845**

The Measurement of Current Transients in a Low Voltage Circuit.—B. T. Barnes, E. Q. Adams & D. D. Hinman. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 426–427.) Measurement of current transients of the order of 1 A/μs, using an oscillograph, is discussed. The construction of a special coaxial type of oscillograph shunt, which has the very low inductance necessary, is described.

621.317.33.011.5 : 621.315.616 **1846**

Dielectric Investigations on Polymeric Fluids.—Goldschmidt. (*See* 1830.)

621.317.333.4 : 621.315.2.029.5 **1847**

New Methods for Locating Cable Faults, particularly on High-Frequency Cables.—Roberts. *See* 1663.)

621.317.336 : 621.315.212.2 **1848**

New Method of Measuring the Impedance Errors of Concentric Pairs.—G. Fuchs. (*Rev. gén. Élect.*, March 1946, Vol. 55, No. 3, pp. 109–117.) A differential method for measuring the asymmetry of quadripoles is applied to the determination of impedance errors arising from dimensional and material irregularities in the construction of concentric cables. Comparison between this differential method and that of Kaden at the resonant frequencies shows good agreement, though both methods fail when similar irregularities are symmetrically located with respect to the mid-point of the cable. Tests carried out at the transmission laboratory of the Société anonyme de Télécommunications show good agreement between experimental and theoretical values for cables with artificial impedance errors.

621.317.336 : 621.317.372 **1849**

On the Measurement of Negative Impedances with a Q-Meter.—B. N. Prakash. (*Electrotechnics*, Dec. 1946, No. 19, pp. 69–73.) Measurements on a *Q*-meter are made (*a*) with a suitable coil connected to the *Q*-meter coil terminals, (*b*) with a tuned circuit, shunted by the impedance, connected to the *Q*-meter capacitor terminals, the impedance being (i) passive, and (ii) active; i.e., with battery supplies connected. The value of the impedance can then be calculated.

621.317.372+621.396.615+621.317.75 **1850**

Service Station Measurement Apparatus : Part 1 — Beat-Frequency Oscillator ; Part 2 — A New Q-Meter ; Part 3 — Frequency Spectrum Analyser.—R. Aschen. (*TSF pour Tous*, Sept.–Nov. 1946, Vol. 22, Nos. 215–217, pp. 171–173, 195–197 & 219–222.) In the beat-frequency oscillator a variable voltage at a fixed frequency F_3 is applied to the control grid of a frequency changer and beats with a second signal of constant voltage but variable frequency F_2 to give an output of variable frequency F_1 whose voltage can be varied from zero up to about 0.05 V. By modulating F_3 either by a.m. or f.m., F_1 is similarly modulated. For *Q*-measurements, the circuit is loosely coupled by a small capacitor to the generator, the resonance frequency F_0 determined and the voltage V measured by a valve voltmeter. F_3 is then varied by a known amount ΔF to give a 30% reduction of V, when $Q = F_0/2\Delta F$. Modification of this simple method gives a direct reading instrument. The frequency analyser, whose circuit diagram is given, displays the components of a signal on the 50 cm × 50 cm screen of a separate c.r.o., the horizontal scale giving the frequency and the vertical the voltage of the various components.

621.317.372 **1851**

A New Q-Meter.—L. Liot. (*Télévis. franç.*, Dec. 1946, No. 20, Supplement *Électronique*, pp. 6–7.) Describes the principles and operation of the Aschen meter. For the original account see 1850 above.

621.317.39 : 531.76 **1852**

The Measurement of Small Time Intervals by Electrical Bridge Methods.—L. U. Hibbard. (*Proc. Instn Radio Engrs, Aust.*, Dec. 1946, Vol. 7, No.

12, pp. 18–19.) Abstract of a paper read before the Physics Section of the 25th Congress of the Australian and New Zealand Association for the Advancement of Science. Wartime developments for radar equipments included a coarse and fine potentiometer with an accurately exponential law and a balanced amplifier for the bridge circuit output.

621.317.431 **1853**

B-H Meter for Samples of Small Cross-Sectional Area.—E. C. Crittenden, Jr, C. S. Smith, Jr, & L. O. Olsen. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 372–374.) Displays on a c.r.o. the hysteresis loop of samples with cross-sections of the order of 10^{-5} cm^2.

621.317.6 : 621.396.619 **1854**

Direct-Reading Modulation Meter.—D. W. Atchley, Jr, & R. E. Fricks. (*QST*, Feb. 1947, Vol. 31, No. 2, pp. 55–57..146.) The meter makes use of the 1N34 germanium crystal diode, thus avoiding the necessity of power supplies and eliminating the triode amplifier stage. Uniformity of these crystal diodes renders individual calibration unnecessary.

621.317.6 : 621.396.619.11 **1855**

On an Amplitude Modulation Meter for Receiving Stations.—S. M. Dasgupta. (*Electrotechnics*, Dec. 1946, No. 19, pp. 64–68.)

621.317.7 **1856**

Trend and Development in Meters and Instruments.—L. J. Matthews. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, pp. 39–44.) Summary of the inaugural address by the Chairman of the I.E.E. Measurements Section. Several types of instrument for measurement or control are included, though the main subject is electricity supply meters. For other accounts see *Electrician*, 1st Nov. 1946, Vol. 137, No. 3570, pp. 1225–1226, and *Engineer, Lond.*, 8th Nov. 1946, Vol. 182, No. 4739, pp. 414–415.

621.317.7 : 621.396.677 **1857**

Radio-Frequency Measurements on Rhombic Antennae.—W. N. Christiansen, W. W. Jenvey & R. D. Carman. (*A.W.A. tech. Rev.*, Dec. 1946, Vol. 7, No. 2, pp. 131–144.) Two instruments are described for investigating performance. One is an impedance meter and the other is for measuring the r.f. current flowing in an elevated horizontal conductor. The use of these instruments is described and some typical results given.

621.317.71/.72] : 621.396.694.015.33 **1858**

Pulse-Type Tester for High-Power Tubes.—E. C. Easton & E. L. Chaffee. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 97–99.) For measuring simultaneously peak voltage and current for both plate and grid of a triode, when the grid current consists of very short pulses.

621.317.72.027.7 **1859**

Meter for High Voltage Measurement.—H. Alfvén & S. Eklund. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 353–356.) An instrument covering the range 2–100 kV and using a capacitance voltage divider combined with a special automatic earthing device.

621.317.725 **1860**

Measuring Complex Components of Voltage.—G. E. Pihl. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 128–131.) To the unknown voltage, assumed of sinusoidal waveform and reasonably good frequency stability, a relatively large reference voltage is added and the resultant is measured by an a.f. valve voltmeter arranged so that the component of the unknown voltage in phase with the reference voltage is measured directly. The phase of the reference voltage is then advanced by 90° and the imaginary component is measured similarly. Circuit details and operation are described. Full scale range can be 1, 5, 10 or 50 V, while the frequency range is 20–20 000 c/s.

621.317.725 **1861**

Super-Sensitive Voltmeter [WV-73A].—(*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, pp. 28–29.) An R.C.A. instrument combining a high gain audio amplifier and diode rectifier in the meter circuit.

621.317.73.029.63 **1862**

Precision Impedance Measurement Apparatus for Decimetre Waves.—H. Klauser. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, p. 223.) An accurately constructed Lecher-wire system with sliding bridge is used for the measurement of the reflection coefficient, from which the unknown impedance is easily calculated.

621.317.794.029.6 **1863**

Apparatus for Radiation Measurements on Metre and Decametre Waves.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 17th July 1946, Vol. 223, No. 3, pp. 143–144.) A local generator produces a current equal in value to that in the receiving aerial, coil or dipole to be measured, by means of a coupling circuit using toroidal coils. The wavelength of the coupling circuit is small compared with that of the wave to be measured, so that the mutual inductance between coupling circuit and aerial is effectively constant up to high frequencies. This mutual inductance is measured when the apparatus is calibrated. The coupling circuit includes a thermoelectric couple for current measurement. Operational details are discussed.

621.396.619.15.083 **1864**

Keying Monitors.—W. A. Roberts. (*Wireless World*, Feb. 1947, Vol. 53, No. 2, p. 73.) Circuit diagram and description of a keying monitor which is in effect an a.f. oscillator with the high voltage "obtained by self-rectification of the signals radiated from the transmitting aerial and picked up by the monitor".

679.5 : [621.315.616 + 539.4 **1865**

Standard Tests for Thermosetting Plastics.—(*Schweiz. Arch. angew. Wiss. Tech.*, Oct. 1944, Vol. 10, No. 10, pp. 323–330.) Test methods standardized by the Swiss Society of Machine Constructors for measuring dielectric breakdown strength, dielectric constant and loss factor, coefficient of linear expansion, density and modulus of elasticity.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

537.533.72 **1866**

The Study of Very Small Structures with the Electron Microscope.—L. de Broglie. (*C. R. Acad.*

Sci., Paris, 30th Sept. 1946, Vol. 223, No. 14, pp. 490–493.) Further discussion of the effect of the impact of particles from the source on the object (see 1545 of May) shows that when the particles are sufficiently rapid to enable details of atomic structure to be discerned, they are liable to detach the atom from the parent body and even to modify its internal structure by withdrawing electrons. It would therefore appear that, even with microscopes using very high voltage protons, it will be impossible to see the structure of atoms.

537.533.73 **1867**

Measurements of the Relative Intensity in Electronic Debye-Scherrer Diagrams.—S. v. Friesen & S. Lenander. (*Ark. Mat. Astr. Fys.*, 11th Feb. 1947, Vol. 33, Part 4, Section A, No. 20, 16 pp. In English.) Measured intensity distribution differs widely from theoretical predictions; the difference is in the same direction as that found by Ornstein.

538.691 : 539.163.2 **1868**

An Inhomogeneous Ring-Shaped Magnetic Field for Two-Directional Focusing of Electrons and Its Application to β-Spectroscopy.—N. Svartholm & K. Siegbahn. (*Ark. Mat. Astr. Fys.*, 11th Feb. 1947, Vol. 33, Part 4, Section A, No. 21, 28 pp. In English.) Dispersion and resolving power are included in a detailed account of the theory. Constructional details are given of a β-ray spectrograph using this focusing system.

539.16.08 **1869**

Types of Geiger-Müller Counters [Zählrohr und Spitzenzähler].—C. Brinkmann. (*Z. InstrumKde*, Jan./March 1944, Vol. 64, Nos. 1/3, pp. 46–64.)

539.16.08 **1870**

The Geiger-Müller Counter with a Hollow Anode.—T. Mikhaleva. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 3, p. 296.)

539.16.08 **1871**

Geiger-Müller Counter Characteristics in the Neher-Harper Circuit.—K. Siegbahn. (*Ark. Mat. Astr. Fys.*, 6th Feb. 1947, Vol. 33, Part 3, Section B, No. 7, 5 pp. In English.) The marked effect of the pentode grid potential upon the characteristics of tube counters is shown graphically, and must be examined whenever a new size and type of G.-M. counter is introduced into the circuit.

539.16.08 **1872**

The Theory of Misses in an Electromagnetic Numerator at the Output of a Dividing Scheme with a Geiger-Müller Counter.—E. Berlovich. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 547–552. In Russian, with English summary.)

539.16.08 **1873**

Statistics of Misses in Geiger-Müller Counters.—E. Berlovich. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 543–546. In Russian, with English summary.) A new formula for correcting for misses is derived, and existing theories are criticized.

550.83 : 621.317.49 **1874**

The Airborne Magnetometer.—G. Muffly. (*Geophys.*, July 1946, Vol. 11, No. 3, pp. 321–334.) A discussion of the problem of magnetic exploration for oil from an aircraft, with a detailed description of apparatus using an automatically-stabilized total-field magnetometer for continuous recording.

621.317.39 : 531.7 **1875**

Electric Amplification in Metrology.—J. Villey. (*Rev. sci., Paris*, Feb. 1945, Vol. 83, No. 3241, pp. 114–117.)

621.318.572 **1876**

Measurement of High Intensities with the Geiger-Mueller Counter.—C. O. Muehlhause & H. Friedman. (*Rev. sci. Instrum.*, Nov. 1946, Vol. 17, No. 11, pp. 506–510.) The maximum counting rate of a typical G.-M. counter may be extended to 100 000 per second by providing high pulse amplification. If a single large counter is replaced by a parallel combination of several small counters the limit of resolving power is set by the speed of the electronic counter.

621.318.572 : 519.283 **1877**

On the Distribution of Counts in a Counting Apparatus.—N. Hole. (*Ark. Mat. Astr. Fys.*, 6th Feb. 1947, Vol. 33, Part 3, Section B, No. 8, 8 pp. In English.) Continuation of 3336 of 1946, giving further calculations on the statistical problems arising in connexion with a counting apparatus receiving impulses with a known distribution of intervals.

621.318.572.015.33 **1878**

Final Stage of an Electronic Pulse Counter registering once for Any Number of Received Pulses.—T. Kahan & A. Kwartiroff. (*C. R. Acad. Sci., Paris*, 9th Dec. 1946, Vol. 223, No. 24, pp. 988–989.) Circuit arrangements with practical details are described whereby the received pulses, whatever their nature, are transformed into a series of identical pulses. An accumulation stage is then used to obtain a scale of the required order.

621.365 **1879**

Industrial Applications of High Frequency.—H. Baumgartner. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 204–210.) Curves show the changes in permittivity and loss factor of several rubbers during h.f. vulcanization, and of whitewood during h.f. drying. Methods of case-hardening gear teeth are described and the results illustrated.

621.365.92 **1880**

Radio-Frequency Heating, with Special Reference to Dielectric Heating.—J. H. Suker. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, pp. 55–56.) A general survey of the principles and methods of r.f. heating at present in use, and of the design of electronic r.f. power generators. Summary of an I.E.E. Students' section paper.

621.38 : 6 **1881**

Electronics in Industry.—H. A. Thomas. (*Elect. Rev., Lond.*, 24th Jan. 1947, Vol. 140, No. 3609, p. 154.) Summary of an I.E.E. paper. For another account see 1531 of May.

621.38 : 621.317.7 **1882**

Electronics in Measurements.—R. J. Kryter. (*Elect. Engng, N.Y.*, Jan. 1947, Vol. 66, No. 1, pp. 31–35.) The advantages and limitations of electronic methods are discussed and some typical applications to measurements not otherwise possible are described.

621.38.001.8 : 667.64 **1883**

Electrostatic Painting.—V. Zeluff. (*Sci. Amer.*, Dec. 1946, Vol. 175, No. 6, pp. 252–254.) Equipment and technique using electrostatic fields to control paint particles and so prevent waste and excess deposits on objects being sprayed.

621.384.6 **1884**

20-Million-Volt Betatron.—(*Mech. Engng, N.Y.*, Jan. 1947, Vol. 69, No. 1, pp. 34–35.) The first betatron to be used for industrial radiographic inspection has recently been installed at the Picatinny Arsenal, Dover, N.Y.

621.384.6 **1885**

Largest Cyclotron ready for Service.—(*Mech. Engng, N.Y.*, Jan. 1947, Vol. 69, No. 1, p. 84.) The 184-inch University of California cyclotron is now ready for service and is expected to produce protons with an energy of 3.5×10^8 eV, and α-particles of 4×10^8 eV.

621.384.6 : 621.317.311 **1886**

A Cyclotron Beam Current Integrator and Recorder.—E. A. Hamacher. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 364–368.)

621.384.6 : 621.396.611.4 **1887**

The Study of a Certain Type of Resonant Cavity and Its Application to a Charged Particle Accelerator.—Akeley. (*See* 1708.)

621.385.83.032.29 **1888**

High Current Electron Guns.—Field. (*See* 1967.)

621.385.833 **1889**

Report of the Electron Microscope Society of America's Committee on Resolution.—W. G. Kinsinger, J. Hillier, R. G. Picard & H. W. Zieler. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 989–995.)

621.386 **1890**

A Survey of Engineering Radiography.—V. E. Pullin. (*Engineer, Lond.*, 10th Jan. 1947, Vol. 183, No. 4748, pp. 40–42.) A general account of the application of X rays to the inspection of light alloy castings, steel castings, fuses, welds and complex assemblies.

621.392.029.63 : 535.33 **1891**

Microwave Spectroscope.—(*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, p. 26.) For spectrochemical analysis of vapours, using wavelengths from 1.2 to 1.6 cm. The vapour under test is sealed in a waveguide excited by an oscillator swept in synchronism with the horizontal sweep of a c.r.o. The output of the crystal detector gives vertical deflexions for the various characteristic absorption bands.

621.396 : 539.172.4 **1892**

Electronics — Workhorse at Bikini.— (*Elect. Engng, N.Y.*, Jan. 1947, Vol. 66, No. 1, pp. 6–10.) Description of instrumental work associated with the Bikini atom bomb tests. In order to discover the causes as well as the effects of damage to standard military equipment, arrangements were made for (*a*) direct observation by television of the blast and its effects, including wave heights, (*b*) telemetering of air and water pressures and radioactivity, (*c*) study of electromagnetic wave effects including radio and radar monitoring, and (*d*) precise measurement of the relative timing of explosion phenomena. Drone boats were guided into the contaminated area by remote control. Summary of papers presented by D. G. Fink and T. D. Hanscome at a joint meeting of the A.I.E.E. (New York section), the New York section of the I.R.E., and the Radio Club of America.

621.396.615.029.58 : 545.38 **1893**

Use of High-Frequency Oscillators in Titrations and Analyses.—F. W. Jensen & A. L. Parrack. (*Industr. Engng Chem.* (*Analyt. Edit.*), Oct. 1946, Vol. 18, No. 10, pp. 595–599.) Changes of the ionic or dipole content in ionized or un-ionized solutions are observed by means of the changes in anode current of a 15-Mc/s oscillator with tuned anode and tuned grid, the liquid being in a container placed inside the anode coil. The method gives sharp indication and has the advantage that no electrodes are inserted in the liquid.

621.396.96 : 371.3 : 534.321.9 **1894**

H_2S Trainer.—Dummer. (*See* 1797.)

621.398 : 621.396.933 **1895**

Electronic Commutation for Telemetering.—L. L. Rauch. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 114–120.) A method of time-division multiplexing wherein short samples of the various instrument or gauge readings are converted into pulse signals and transmitted in cyclic serial order over a f.m. radio link. 18 channels can each be sampled 952 times per second. A master pulse generator controls broken-ring trigger stages. The main application is to flight tests of new or pilotless aircraft.

621.791.76 **1896**

Conversion of Energy into Heat during the Transient Stage in Resonant Circuits. Application to Electric Welding.—D. Genkin. (*C. R. Acad. Sci., Paris*, 17th July 1946, Vol. 223, No. 3, pp. 140–141.) If the circuit has only resistance and inductance the quantity of heat released at a point weld in the first 3–5 cycles depends on the phase of the e.m.f. at the instant of closing, so that some welds are burnt while others are insufficiently welded. With a capacitor connected in series and tuned to resonance with the supply frequency the heat developed increases regularly with the time whatever the phase of the e.m.f. and hence much better control of spot welding is possible.

537.533.72 + 621.385.833 **1897**

The Electron Microscope. [Book Review]—E. F. Burton & W. H. Kohl. Reinhold Publishing Corporation, New York, 2nd edn 1946, 325 pp., $4. (*Rev. sci. Instrum.*, Oct. 1946, Vol. 17, No. 10, pp. 441–442.) The second edition, with the text rearranged and many parts rewritten to produce a greatly improved volume. The book is addressed essentially to the non-technical reader.

621.386 : 620.11 **1898**

Engineering Radiography. [Book Review]—Emmott & Co., Manchester, 57 pp., 2s. 6d. (*Electrician*, 10th Jan. 1947, Vol. 138, No. 3580, p. 134.) "Mechanical World" Monograph No. 26. An introduction to the application of X rays and gamma rays to analysis and inspection.

PROPAGATION OF WAVES

538.569.4 + 621.396.812].029.64 : 551.51 **1899**

Atmospheric Absorption Measurements with a Microwave Radiometer.—Dicke, Beringer, Kyhl & Vane. (*See* 1843.)

621.3.011.5.029.5/.6] : 631.437 **1900**

Dielectric Properties of Indian Soils at High and Medium Radio-Frequencies.—S. R. Khastgir, J. N. Ray & A. Banerjee. (*Indian J. Phys.*, Aug. 1946, Vol. 20, No. 4, pp. 119–147.) Dielectric properties of various soils and their variation with packing, moisture content, and frequency of alternating field are examined by differential transformer and oscillographic methods. Theory and experimental procedure are given. The constants of soils from various parts of India are compared.

621.396.11 **1901**

Solution of the Problem of Propagation of Electromagnetic Waves along the Earth's Surface by the Method of Parabolic Equation.—M. Leontovich & V. Fock. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 7, pp. 557–573.) Application of Leontovich's parabolic equation method to a plane earth leads to the well known Weyl–van der Pol formula; applied to a spherical surface it gives the formula Fock obtained by infinite summation of a more rigorous solution.

621.396.11 **1902**

On the Propagation of Radio Waves along an Imperfect Surface.—E. Feinberg. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 5, pp. 410–418.) Formulae are derived for the field perturbation and change of direction of propagation produced by a surface composed of sea, a linear shore slope, and land of finite conductivity. A term representing the effect of the transition zone must be added to equations previously used in the treatment of coastal refraction. Some relevant experiments are also discussed. For parts 1, 2, and 3 see 2529 of 1945 and 1962 of 1946.

621.396.81.029.64 **1903**

Millimetre Wave Propagation.—H. R. L. Lamont & A. G. D. Watson. (*Nature, Lond.*, 28th Dec. 1946, Vol. 158, No. 4026, pp. 943–944.) Propagation tests over sea at wavelengths of 5.81 mm and 6.35 mm are described and received signal/distance curves given. At λ 5.81 mm, the results indicate an atmospheric absorption of about 1.5 db/km. At λ 6.35 mm the mean level closely follows the expected inverse distance law. From laboratory experiments at 8.7 mm, the reflection coefficient of a plane sea surface for grazing angles is between 0.88 and 0.97. See also 3396 of 1946.

621.396.812 : 551.510.535 **1904**

Radio Waves and the Ionosphere.—Howe. (*See* 1779.)

621.396.812 + 551.510.535 **1905**

Echoes on Short Waves at Low Altitude.—Jouaust. (*See* 1776.)

621.396.812.4 : 551.510.535 **1906**

The Validity of Ionospheric Forecasts.—T. W. Bennington. (*B.B.C. Quart.*, Oct. 1946, Vol. 1, No. 3, 9 pp. Reprint.) A general article on the prediction and use of optimum working frequencies (O.W.F.), assessed as 15% below the maximum usable frequency (M.U.F.). M.U.F. predictions are based on normal ionospheric and solar variations, and are plotted as ionospheric contour charts on a Mercator projection, the surface of the earth being covered in three zones. Increased knowledge of the effects of sporadic-E ionization may lead to the provision of sporadic-E contour charts for use in conjunction with ionospheric contour charts. Sudden ionospheric storms are described, and the difficulty of forecasting them is pointed out.

621.392.52 + [548.0 : 538.3 **1907**

Wave Propagation in Periodic Structures : Electric Filters and Crystal Lattices. [Book Review]—L. Brillouin. McGraw Hill Book Co., New York & London, 1946, 247 pp., 20s. (*Nature, Lond.*, 28th Dec. 1946, Vol. 158, No. 4026, p. 926.) The propagation of waves in two- and three-dimensional lattices and the filtering properties of such systems are discussed. The application of the same mathematical treatment to problems of pure physics is also explained.

RECEPTION

621.385.3 + 621.396.694] : 621.396.645 **1908**

Grounded-Grid Technique.—Knowles. (*See* 1965.)

621.394/.397].822 : 530.162 **1909**

Study of Fluctuations produced by the Shot Effect in Amplifiers.—Blanc-Lapierre. (*See* 1841.)

621.396.6 **1910**

A Quiet Break-In System.—C. L. Robinson. (*QST*, Feb. 1947, Vol. 31, No. 2, pp. 33–35.) A description of a smooth receiver-silencing system.

621.396.61/.62 **1911**

Operating the BC-645 on 420 Mc/s.—Ralph & Wood. (*See* 1957.)

621.396.62 : 621.396.611.21 **1912**

Receiver with Automatic Tuning and Quartz Control.—A. V. J. Martin. (*Radio en France*, 1947, No. 1, pp. 17–18.) A receiver circuit is described, with detailed diagram, using quartz control of the local oscillator frequency. The input circuit is tuned to different stations by means of pre-set capacitors.

621.396.621 + 621.396.69 **1913**

New Methods of Radio Production.—J. A. Sargrove. (*J. Brit. Instn Radio Engrs*, Jan./Feb. 1947, Vol. 7, No. 1, pp. 2–33.) Insulating plates are moulded into such a structural form that, when fully processed without manual aid, they contain the inductors, capacitors, resistors, potentiometer tracks, switch and other terminations, together with conductor paths, in an interrelated and interconnected manner, the plate material forming the dielectric of the capacitors. Full details are given of the methods adopted for making connexions through the plates for larger capacitors and inductances, fitting valve sockets, using the inside walls of the moulded cabinet for the larger resistors, etc. The manufacturing process is completely automatic. The plates, after infra-red drying, sandblasting and cleaning to remove grit, are metallized on both sides by spraying and then surface-milled to remove all projections, leaving the metal only in the grooves and depressions. The resistors are added by graphite spraying through stencils. Automatic timing ensures the accuracy of resistor values. Successive machines remove unwanted plastic, metal or graphite from holes, slots, etc., and insert metal sockets for valves, electrolytic capacitors, loudspeakers etc. The sockets are fixed permanently by a combined riveting, welding and soldering operation. After electrical overload tests and thermal aging the plates are lacquered, dried and passed to a conveyor belt where other parts are added, some manually. Automatic testing is applied at every stage of the process. Failure of any stage shuts down all previous ones. After a final radio signals test, the completed sets are automatically packed and sealed. The complete outfit is known as E.C.M.E.—Electronic Circuit-Making Equipment—and has obviously wide applications to the speedy production of cheap, light-weight and uniform communication apparatus of many types.

621.396.621 **1914**

Ekco Model A28.—(*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 54–56.) Test report on a table model receiver for a.c. mains.

621.396.621.5 : 573.312.62 **1915**

Demodulation by Superconductivity.—D. H. Andrews & C. W. Clark. (*Nature, Lond.*, 28th Dec. 1946, Vol. 158, No. 4026, pp. 945–946.) Demodulation of broadcast waves can be effected with superconducting bolometers of columbium nitride operated within certain temperature limits. Quality is comparable with that of good standard radio reception.

621.396.621.54 **1916**

Home-Constructed Communications Superhet.—A. B. Wright. (*Short Wave Mag.*, Oct. & Nov. 1946, Vol. 4, Nos. 8 & 9, pp. 470–478 & 546–551.) Constructional details for a receiver of conventional design suitable for amateur use.

621.396.621.54 **1917**

"Single-Span", a 4-Valve Single Range Superhet for A.C. Mains.—V. Stuzzi. (*Radio Welt*, Dec. 1946, Vol. 1, No. 4, pp. 69–74.) The range is 200–2 000 m without switching. Constructional and circuit details are given.

621.396.662 : 621.396.62 **1918**

Tuning Devices for Broadcast Radio Receivers.—R. C. G. Williams. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, pp. 59–61.) Summary of 1194 of April.

621.396.8.015.33 : 621.396.82 **1919**

A Theoretical Comparison of the Visual, Aural, and Meter Reception of Pulsed Signals in the Presence of Noise.—J. H. Van Vleck & D. Middleton. (*J. appl. Phys.*, Nov. 1946, Vol. 17, No. 11, pp. 940–971.) The paper gives detailed theoretical studies of the dependence of the sensitivity of the three methods on various parameters including the width and shape of the i.f. response, the pulse length, the pulse recurrence frequency and, in aural or meter reception, the duration of the gate, the width of the audio filter, and the time constant of the meter.

621.396.812.3 **1920**

Diversity Reception.—Z. Jelonek, E. Fitch & J. H. H. Chalk. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, pp. 54–62.) The diversity gain is a measure of the permitted reduction of signal level for a given fractional time loss of signal when more than one signal is used. This is evaluated for two- and three-signal systems, assuming independent fading with a Rayleigh or a square-law probability-integral function. The bivariate Gaussian distribution is used to study the case of correlated two-signal fading. Experimental data on fading are given for ionospheric waves and for centimetre-wave propagation over long paths.

621.396.82 : 523.5 **1921**

Radar Detection of Meteor Trails.—Appleton & Naismith. (*See* 1752.)

621.396.821 : 551.594.221 **1922**

The Nature and Variation of Atmospherics caused by Lightning Discharges.—Norinder & Stoffregen. (*See* 1784.)

621.396.822.029.63 : 523.72 **1923**

Solar Radiation at 480 Mc/s.—Reber. (*See* 1760.)

621.396.828 : 061.3 **1924**

Radio Interference.—(*Wireless World*, Feb. 1947, Vol. 53, No. 2, p. 67.) Brief note of an international conference in London called by the British Standards Institution to consider radio interference suppression.

621.396.828 : 551.508 **1925**

Reduction of Radio Interference from Meteorological Installations.—R. L. Ives. (*Bull. Amer. met. Soc.*, Feb. 1946, Vol. 27, No. 2, pp. 59–61.) Interference is of three types, stray magnetic fields, l.f. oscillations and r.f. oscillations. Methods for its reduction are given.

621.396.828 : 621.396.645.029.3 **1926**

Hum in High-Gain Amplifiers.—Baxandall. (*See* 1689.)

STATIONS AND COMMUNICATION SYSTEMS

621.39 + 534.756 **1927**

Theory of Communication.—D. Gabor. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, p.58.) Summary of 1057 of April.

621.396.215 **1928**

Transmitter-Receiver Broadcasting System with Two Channels on a Single Carrier Wave.—J. Donnay. (*Radio en France*, 1945, No. 4, pp. 3–5 & 1946, No. 1, p. 18.) A rectangular signal with frequency of the order of 10 to 40 kc/s is applied to the transmitter; the positive and negative half-cycles cut out the audio modulation for the first and second channels respectively. At the same time the amplitude of the crests of the rectangular signal is modulated by the audio frequency to be transmitted on each channel. A signal of complex modulation is thus obtained which can be used for the transmission of two programmes. A suitable discriminating system in the receiver allows programme selection. In practice it is found preferable to separate the positive and negative crests by short quiescent periods.

621.396.24.029.63/.64 **1929**

Problems of Intelligence [speech or music] **Transmission on Microwaves.**—H. J. v. Baeyer. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 198–203.) A general discussion, with special treatment of the problems of generation, transmission and reception of wavelengths between 2 and 20 cm. Comparison is made between single channel a.m. and f.m., multichannel methods using frequency transposition for each channel, and pulse modulation systems.

The latter are particularly suitable when the number of channels is large.

621.396.44 **1930**

Development and Present Position of Multichannel Directional Technique.—E. Huber. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 182–185.) From a discussion of possible systems it is concluded that for a small number of channels (up to about 12) an adaptation of cable carrier-frequency technique gives the best results. A short description is given of two equipments, one providing two telephony and two telegraphy channels (a modification of the military equipment described in 1937 below) and the other six telephony channels, f.m. being used in both sets.

621.396.61[.62].029.64 **1931**

Dishing Out the Milliwatts on 10 kMc/s.—J. A. McGregor. (*QST*, Feb. 1947, Vol. 31, No. 2, pp. 58–61, 148.) The transmitter uses a type 723A/B valve and gives about 35 mW. With a 30-inch parabolic reflector and dipole aerial, very strong signals were obtained at a range of 2 miles, using a Hallicrafter S-29 portable receiver.

621.396.619.16 **1932**

The Application of Pulse Technique to Broadcasting.—H. L. Kirke. (*B.B.C. Quart.*, Oct. 1946, Vol. 1, No. 3, 6 pp. Reprint.) If the pulse amplitude in the receiver is limited, the signal/noise ratio is proportional to the steepness of the sides of the pulse provided the bandwidth passes the pulse without distortion. The pulse duration determines the ratio of the pulse-recurrence frequency to the highest audio frequency transmitted. A comparison with other systems shows that for a high-fidelity, low-noise service, pulse modulation is inferior to frequency modulation. The apparatus for a single-transmitter, multichannel system is simple but a greater bandwidth is required than for a frequency modulation system with separate transmitter. There is also a danger of cross-talk in the pulse-modulation system due to multi-path transmission.

621.396.619.16 **1933**

Pulse Time Modulation.—P. Güttinger. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 188–192.) The general principles of pulse modulation, and particularly of pulse time modulation, are explained. Broad frequency bands are required if this method is to be used to the greatest advantage, so that its main application is to microwaves. It also enables interference effects to be reduced considerably, as with f.m. A special feature of the system described gives a linear relation between the pulse lengths and the modulation values at fixed and equal time intervals which do not depend on the modulation process.

621.396.712 : 621.396.81 **1934**

Site Selection and Field Intensity Surveys for Broadcasting Stations.—R. Gill. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1946, Vol. 7, No. 11, pp. 7–21.) The basic coverage requirements of a medium-wave broadcasting station are outlined and the factors governing the service area of such a station are examined. Survey procedure is described, with typical examples. The requirements for the siting of transmitters for f.m. v.h.f. operation are discussed and details given of a survey in the Sydney area using a mobile v.h.f. transmitter.

621.396.72.029.62 **1935**

First Steps on Five [metres].—J. Hum. (*Short Wave Mag.*, Nov. 1946, Vol. 4, No. 9, pp. 541–545.) Reconstruction of existing equipment to obtain a superheterodyne converter, a beam aerial, and a transmitter for 58-Mc/s amateur use.

621.396.72.029.63 **1936**

Simple Decimetre Directional Equipment.—R. Schüpbach. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 181–182.) The set comprises transmitter, receiver and supply units, works on a fixed frequency in the range 300–330 Mc/s and with a transmitter power of 1–2 W has a working range up to 10 km.

621.396.73.029.63 **1937**

Portable Decimetre Equipment for Military Directional Links.—R. Schüpbach. (*Brown Boveri Mitt.*, Aug. 1946, Vol. 33, No. 8, pp. 178–181.) The transmitter and receiver are of unit construction and operate in the range 330–355 Mc/s with a transmitter f.m. of ± 75 kc/s. With relay stations good communication is achieved at distances of several hundred kilometres.

621.396.75 **1938**

Directional Communication System.—H. Köhler. (*Radio Welt*, Dec. 1946, Vol. 1, No. 4, pp. 64–69.) A general account of basic principles, aerial systems, transmitting and receiving equipment.

621.396.9.029.63 **1939**

Interesting Applications of Decimetre Waves in the Communications and Remote Supervisory Control Fields.—R. Schüpbach. (*Brown Boveri Rev.*, Dec. 1945, Vol. 32, No. 12, pp. 453–456.) A survey of many possible uses of equipment at wavelengths in the region 0.8–1.5 m, which have definite advantages, particularly for beam transmission.

621.396.932 **1940**

Naval Radio Gear.—G. M. Bennett. (*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 62–64.) Details of British naval communication systems used in large warships.

621.396.96 : 621.396.82 **1941**

Radar Reflections from Long Conductors.—Bloch, Hamermesh & Phillips. (*See* 1687.)

621.396.97(54) **1942**

Ultra Short Waves to replace Medium Waves for Regional Broadcasting in India.—S. P. Chakravarti. (*Electrotechnics*, Dec. 1946, No. 19, pp. 5–18.) A review of the broadcasting policy of India, and a comparison between medium and ultra-short waves is made. The problems of u.h.f. regional broadcasting are discussed and the advantages of ultra-short waves for dual programme transmission are stated. Finally, a scheme for India using 70 stations each of $\frac{3}{4}$ kW power working in the frequency range 60–150 Mc/s is suggested.

621.396.97.029.6 : 621.396.619 **1943**

Broadcasting at V.H.F.—T. Roddam. (*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 70–71.) The relative merits of a.m., f.m., and pulse modulation for v.h.f. broadcasting are considered. In the present state of knowledge, no one of these systems should be adopted to the exclusion of the others.

SUBSIDIARY APPARATUS

621.3.032.53 : 621.51/.52 **1944**
Hermetic Seals and Bushes.—United Insulator Co. (*J. sci. Instrum.*, Nov. 1946, Vol. 23, No. 11, pp. 272–273.) Ceramic bushes are metallized both round a shoulder, to allow soft-soldering to a metal container, and on one end, for soldering a lead-in wire or metal insert. They will withstand vacuum and pressures over 30 lb/sq. inch and have high flashover voltage and insulation resistance.

621.314.5 **1945**
Development of 150 Watts D.C.-A.C. Vibro-Converter of 50 Cycles per Second Fundamental Frequency.—R. N. Dewan. (*Electrotechnics*, Dec. 1946, No. 19, pp. 81–88.) To convert 110/220 V d.c. mains to 110/220 V single-phase a.c. of square-topped waveform having a fundamental frequency of 50 c/s. Extends work previously noted in 754 of 1946.

621.314.6 + 621.319.4 + 621.383] : 669.018 **1946**
Light Alloys in Metal Rectifiers, Photocells, and Condensers.—Continuing the series in *Light Metals* mentioned in 1593 of May and back references.

(xxii) July 1946, Vol. 9, No. 102, pp. 372–378.
Finishing processes in the manufacture of fixed paper capacitors, and certain more recent developments in dielectric and impregnating media.

(xxiii) Aug. 1946, Vol. 9, No. 103, pp. 408–413.
Aluminium and pigmented cellulose lacquers and enamels, with special reference to corrosion resistance and durability tests.

(xxiv) Oct. 1946, Vol. 9, No. 105, pp. 517–524.
Methods of identification marking of fixed paper capacitors, and inspection systems and testing techniques before dispatch.

(xxv) Dec. 1946, Vol. 9, No. 107, pp. 637–642.
The use of plastic film in place of paper and mica in the construction of fixed capacitors.

621.316.93 **1947**
Lightning Protection.—R. C. Cuffe. (*Elect. Rev., Lond.*, 20th Dec. 1946, Vol. 139, No. 3604, p. 1011.) Abstract of a paper presented at a meeting of the Transmission Section of the I.E.E.

621.317.755 **1948**
A Universal Oscillograph.—G. L. Hamburger. (*Electronic Engng*, Jan. & Feb. 1947, Vol. 19, Nos. 227 & 228, pp. 7–10, 22 & 51–57.) A full account of the design of a laboratory instrument of great versatility, with complete circuit diagram, table of components and constructional details. A direct sweep with 5–30% flyback and a repetition rate of 0.5–275 000 c/s is used and an elliptical timebase is also incorporated. Voltage calibration of the trace is direct-reading from 100 mV to 200 V for both a.c. and d.c. The operator can calibrate adjustable audio frequencies up to about 10 kc/s in terms of mains frequency. Mechanical features include a retractable terminal panel and division of the instrument into two main chassis, connected by a hinge, so that all parts are easily accessible.

621.385.832 **1949**
Origin of Trapezoidal Distortion in Cathode-Ray Oscillographs.—A. Cazalas. (*C. R. Acad. Sci., Paris*, 1st July 1946, Vol. 223, No. 1, pp. 27–28.) Experiments show that the distortion is due more particularly to stray lines of force from the ends of the plates which are located furthest from the source. Correction of the effect has been achieved by (*a*) making these plates circular, the centre of the circle being on the axis around which the beam of electrons turns when it is deflected by the other plates and (*b*) introducing between the two pairs of plates a cylindrical screen, concentric with the above circle, maintained at the final anode potential and having a window to allow passage of the beam.

621.394.652 **1950**
Telegraph Key Design.—(*Wireless World*, Feb. 1947, Vol. 53, No. 2, p. 61.) Abstract of article previously noted in 1232 of April.

621.396.682 : 621.316.722.078.3.029.6 **1951**
Power Supply for Microwave Equipment.—O. Hoag. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 110–113.) An electronically controlled servo motor adjusts an auto-transformer. Voltage can be varied between 300 and 5 000 V with less than 3 mV ripple in the d.c. output.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 : 621.385.83.032.29 **1952**
Electron Guns for Television Application.—Morton. (*See* 1968.)

621.397.62 **1953**
Television Receiver Construction : Part 2.—(*Wireless World*, Feb. 1947, Vol. 53, No. 2, pp. 40–42.) Construction and winding data for line deflector coils. For part 1 see 1245 of April.

621.397.621 **1954**
Image Quality and Definition.—P. Hémardinquer. (*Télévis. franç.*, Feb. 1946, No. 10, pp. 17–18..22.) Discusses the optimum results to be expected from a 450-line system. Comparison is made with photographic reproduction.

TRANSMISSION

621.394.652 **1955**
Telegraph Key Design.—(*See* 1950.)

621.394.652 : 621.394.141 **1956**
The Electroplex — a New Automatic Key. — Dixon. (*See* 1699.)

621.396.61/.62 **1957**
Operating the BC-645 on 420 Mc/s.—J. T. Ralph & H. M. Wood. (*QST*, Feb. 1947, Vol. 31, No. 2, pp. 15–21.)

621.396.611.33 : 621.396.671 **1958**
Matching Ranges [plages d'adaptation] **of Transmitters.**—D. Glazer & V. Familier. (*Onde élect.*, Nov. 1946, Vol. 26, No. 236, pp. 430–437.) A transmitter is to be matched to an aerial of resistance R and reactance jX. For a particular frequency f, the possible pairs of values of R and X form an aggregate which is called the matching range (plage d'adaptation). In the general case where f, R, and X all vary, the matching range will be a skew surface when the coupling system has only one degree of freedom, and a volume when it has two degrees of freedom. A method is given, with numerical examples, for determining this matching volume for direct inductive coupling.

621.396.619.13 **1959**

Frequency Modulator.—G. G. Bruck. (*Electronics*, Jan. 1947, Vol. 20, No. 1, pp. 166..170.) Reactance tubes, double diode demodulator, and inverse feedback loop for linearity and mid-frequency control are here combined into a single unit.

621.396.645.36 **1960**

150 Watts Push-Pull.—Thomas. (*See* 1716.)

VALVES AND THERMIONICS

621.383.4 + 546.28 **1961**

A New Bridge Photo-Cell employing a Photo-Conductive Effect in Silicon. Some Properties of High Purity Silicon.—G. K. Teal, J. R. Fisher & A. W. Treptow. (*J. appl. Phys.*, Nov. 1946, Vol. 17, No. 11, pp. 879–886.) A method is described for making bridge type photocells by reaction of silicon tetrachloride and hydrogen gases at ceramic or quartz surfaces at high temperatures. The maximum photo-sensitivity occurs at 8 400–8 600 Å. The sensitivity is about equivalent to that of the selenium bridge; the silicon cell is far more stable and rapid in response. From measurements of the electronic conductivity of silicon as a function of temperature, it is concluded that the same electron bands are concerned in the photoelectric, optical and thermal processes. The low values of specific conductances found (1.8×10^{-5} mho/cm) are ascribed to high purity of the silicon, not polycrystalline structure.

621.383.5.032.21 : 537.533 **1962**

The Emission of Electrons by Active Semi-Conducting Cathodes.—N. D. Morgulis. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 536–545. In Russian with English summary.) Survey of fundamental data concerning various properties of cathodes, used as thermo-emitters, photo-emitters and secondary electron emitters.

621.385 : 519.283 **1963**

Electron Tube Quality Control.—J. R. Steen. (*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, pp. 16–19.) A survey of modern methods of control by sample testing.

621.385 : 621.317.723 **1964**

Improvements in the Stability of the FP-54 [Pliotron] **Electrometer Tube.**—J. M. Lafferty & K. H. Kingdon. (*J. appl. Phys.*, Nov. 1946, Vol. 17, No. 11, pp. 894–900.) Full paper, a summary of which was abstracted in 583 of February.

621.385.3 + 621.396.694] : 621.396.645 **1965**

Grounded-Grid Technique.—R. Knowles. (*Short Wave Mag.*, Nov. & Dec. 1946, Vol. 4, Nos. 9 & 10, pp. 536–540 & 603–608.) The uses of the grounded-grid triode as an r.f. or power amplifier, as an oscillator, or in a.f. amplifiers are discussed. Stage gain, matching, and circuit and constructional details are considered practically. Circuit values are given for a 58-Mc/s r.f. receiver amplifier. Characteristics of commercial valves suitable for grounded-grid working are tabulated.

621.385.3 : 621.396.694.012.8 **1966**

The Equivalent Diode.—W. E. Benham. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, p. 62.) Comment on 949 of March.

621.385.83.032.29 **1967**

High Current Electron Guns.—L. M. Field. (*Rev. mod. Phys.*, July 1946, Vol. 18, No. 3, pp. 353–361.) The limitations in high current electron gun design include a maximum permissible current density, thermal velocities of emission, cathode poisoning, ion bombardment and anode heating. Single and multiple electrostatic guns, and combined electrostatic and magnetic field guns are described, with their relative advantages and limitations.

621.385.83.032.29 : 621.397.5 **1968**

Electron Guns for Television Application.—G. A. Morton. (*Rev. mod. Phys.*, July 1946, Vol. 18, No. 3, pp. 362–378.) A description of the iconoscope, orthicon, image orthicon, and the various electron guns used. A two-lens system is used in the iconoscope, and a low-velocity magnetically-focused beam in the orthicon systems. Diagrams are given for several types of commercial electron guns.

621.396.615.1 : 537.58 **1969**

Effect of Space Charge on the Frequency of Oscillation in Positive-Grid Oscillators.—C. Yeh. (*Chin. J. Phys.*, July 1946, Vol. 6, No. 2, pp. 79–84.) The effect of the non-uniformity of the inter-electrode field in a planar Barkhausen-Kurz tube due to space charge results in a frequency about 10–20% lower than in the absence of a space charge.

MISCELLANEOUS

001.4 **1970**

The Use of Standard Terms and Symbols.—G.W.O.H. (*Wireless Engr*, Feb. 1947, Vol. 24, No. 281, p. 34.) Several examples of confusion caused by slipshod use of symbols are given. See also 960 of March.

519.283 : 621.385 **1971**

Electron Tube Quality Control.—Steen. (*See* 1963).

621.3.016.25 **1972**

The Sign of Reactive Power.—E. W. Kimbark: H. K. Sels: R. H. Lindsay: G. A. Irland: W. V. Lyon. (*Elect. Engng, N.Y.*, Jan. 1947, Vol. 66, No. 1, pp. 107–110.) Further comment on 971 of March; see also 1289 of April. Agreement is expressed with the recommendation that the previously adopted sign of reactive power should be changed, but comment is made on some of the definitions suggested.

621.39 : 371.3] + 621.315.6 **1973**

The War-Time Education and Training of Radio Personnel and Recent Developments in Dielectric Materials.—W. Jackson. (*J. Instn elect. Engrs*, Part I, Jan. 1947, Vol. 94, No. 73, pp. 26–34, and Part III, Jan. 1947, Vol. 94, No. 27, pp. 2–10.) Details are given of the courses organized by the Wireless Personnel Committee for radio and wireless mechanics, radio officers, and of a post-graduate course in high vacua and electronics.

The structure of carbon, silicon, and titanium compounds, and its relation to their dielectric properties, is considered in detail.

Summaries of this paper were noted in 314 of January.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.213 : 539.31 : 678.7 **1974**

Acoustic Determination of the Physical Constants of Rubber-Like Materials.—A. W. Nolle. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 194–201.)

534.22.093.3-8 **1975**

Temperature Coefficient of Ultrasonic Velocity in Solutions.—G. W. Willard. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 235–241.) Measurements at 10 Mc/s of the velocity in liquids and liquid mixtures. All liquids tested except water have large negative temperature coefficients in the range 0–80°C. Water has a large positive coefficient at normal temperature, which decreases to zero at 74°C and then becomes negative. Increase of concentration raises the peak velocity slightly.

534.232 **1976**

Asymmetrical Vibrations of Cones.—P. G. Bordoni. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 146–155.) The natural frequencies of a cone are the same as those of a disk of the same radius and thickness if the diameter is greater than eight times the wavelength of the vibration. If this ratio n is less than eight the frequencies are p times those of the corresponding disk, where

$$p = 1 + \sin \phi \left\{1 - \cos (\pi/2n)\right\}$$

and ϕ is the total apex angle.

534.232 **1977**

Acoustic Wave Fronts from a "Piston" Source.—A. O. Williams, Jr. (*J. Acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 156–161.) Calculation of the shape of wave fronts generated by a concave piston source. A few rough comparisons with experimental results are given.

534.26 **1978**

Diffraction of Sound around a Circular Disk.—H. Primakoff, M. J. Klein, J. B. Keller & E. L. Carstensen. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 132–142.) Computations based on the Kirchhoff surface integral and the Maggi transformation. Comparison is made with calculations using Green's function.

534.78 **1979**

Factors governing the Intelligibility of Speech Sounds.—N. R. French & J. C. Steinberg. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 90–119.) Characteristics of speech, hearing, and noise are discussed in relation to intelligibility. It is shown that intelligibility can be related to a quantity called 'the articulation index' which can be computed from the intensity/frequency relationships for speech and for unwanted sounds received by the ear.

534.78 **1980**

Premodulation Clipping in A. M. Voice Communication.—K. D. Kryter, J. C. R. Licklider & S. S. Stevens. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 125–131.) Saving of 14 db in carrier power can be achieved, without loss in intelligibility, by 24 db of premodulation peak clipping followed by 24 db of linear gain to obtain 100% modulation.

534.78 **1981**

More on Speech Clipping.—W. W. Smith. (*QST*, March 1947, Vol. 31, No. 3, pp. 18–22.) Stresses the importance of design and operating details and gives some new circuits, including a full-wave series clipper maintaining constant load on an RC driving circuit and a high-level half-wave clipper-filter system for use with 8 000-Ω to 10 000-Ω loads and anode voltages up to 2 000. For an earlier article see 1724 of 1946; see also 933 of March.

534.78 : 621.317.35 **1982**

Waveform Analysis of Speech.—J. Dreyfus-Graf. (*Helv. Phys. Acta*, 18th Dec. 1946, Vol. 19, Nos. 6/7, pp. 404–408.) The nature of speech and hearing are expressed as far as possible in terms of analogous electrical circuits of which a block diagram is given.

534.78 (23.03) **1983**

Effects of Distortion on the Intelligibility of Speech at High Altitudes.—G. A. Miller & S. Mitchell. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 120-125.) Using mask-microphone equipment at altitudes of 40 000 ft intelligibility can be improved by amplitude limitation; it may also be desirable to filter out frequencies below 500 c/s. A summary was abstracted in 3522 of 1946.

534.833.4-8 **1984**

Absorption of Supersonic Waves in Water near One Megacycle.—L. W. Labaw & A. O. Williams, Jr. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 30–34.) Absorption measurements between 1.09 and 1.30 Mc/s do not confirm earlier measurements indicative of a strong absorption peak near 1 Mc/s, but a fairly reliable upper limit of the absorption coefficient has been obtained.

534.851 **1985**

Improved Theory of the Light Pattern Method for the Modulation Measurement in Groove Recording.—J. Hornbostel. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 165–169.)

534.851 **1986**

Sound Embossing at the High Frequencies.—M. Morse. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 169–172.) Optimum loading, stylus dimensions, etc., for embossing at 5 000 c/s.

534.851 : 621.395.813 **1987**

Wire Recorder Wow.—A. W. Sear. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 172–178.)

551.596.1 **1988**

Calculation of Sound Rays in the Atmosphere.—P. Rothwell. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 205–221.)

551.596.1 : 534.22-8 **1989**

Ultrasonic Propagation in Open Air.—H. K. Schilling, M. P. Givens, W. L. Nyborg, W. A. Pielemeier & H. A. Thorpe. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 222–234.) Absorption and scattering properties at frequencies up to 30 kc/s.

621.395.623 **1990**

A General Theory of Passive Linear Electroacoustic Transducers and the Electroacoustic Reciprocity Theorem: Part 2. H. Primakoff & L. L. Foldy. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 50–58.) Continuation of 264 of 1946. If a transducer is considered to consist of media characterized by appropriate linear relations between stress, strain, electric and magnetic polarization, charge and current density, and electric and magnetic field intensity, the validity of the linear relations and the 'reciprocity relations' assumed in part 1 can be established, provided certain sufficient conditions are satisfied. These conditions are: (*a*) that the coefficients in the constitutive relations satisfy certain 'symmetry conditions', (*b*) that no magnetostrictive media and no static magnetic field, or no piezoelectric media and no static charge density, are present in the transducer, and (*c*) that the transducer does not radiate electromagnetic waves from its surface.

621.395.623.64.08 **1991**

Headphone Measurements and Their Interpretation.—D. W. Martin & L. J. Anderson. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 63–70.) Fundamental headphone data are presented in a form suitable for users; the importance of analysis of the performance on different wearers is emphasized. Requirements for an improved artificial ear are outlined.

621.395.623.8 **1992**

Radio Translation.—(*Wireless World*, March 1947, Vol. 53, No. 3, p. 96.) At Lake Success six low-power transmitters on frequencies of about 120 Mc/s radiate the original speech and translations in five languages. United Nations General Assembly delegates carry small receivers, with simple dial switches. These have a working range up to 200 yd.

621.395.625 **1993**

Lateral Recording: Part 1.—W. H. Robinson. (*Communications*, Feb. 1947, Vol. 27, No. 2, pp. 26.. 28.) The first of a series of papers giving a general discussion of average electromagnetic and crystal cutters, groove depths, disks, volume indicators, measuring equipment, frequency runs, styli, cutting angles, scratch filters and pickups.

621.395.625.3 **1994**

Recent Developments in the Field of Magnetic Recording.—S. J. Begun. (*J. Soc. Mot. Pict. Engrs*, Jan. 1947, Vol. 48, No. 1, pp. 1–13.) A new type of magnetic tape recorder is described using 8-mm coated paper tape. Frequencies up to 5 000 c/s can be recorded with a tape speed of 7.5 inches/sec.

621.395.625.3 **1995**

A Magnetic Sound Recorder of Advanced Design.—R. J. Tinkham & J. S. Boyers. (*J. Soc. Mot. Pict. Engrs*, Jan. 1947, Vol. 48, No. 1, pp. 29–35.) "Characterized by good frequency response, low distortion, freedom from 'wow' and flutter, and lock-in synchronous drive."

621.395.625.3 **1996**

Magnetic Sound Recording on Coated Paper Tape.—H. A. Howell. (*J. Soc. Mot. Pict. Engrs*, Jan. 1947, Vol. 48, No. 1, pp. 36–46. Discussion, pp. 46–49.) The factors affecting the choice of magnetic material and backing medium are considered; this leads to a discussion of the performance of paper tape recording systems. The properties of a recently developed tape are shown graphically.

621.395.625.3 : 778.5 **1997**

Magnetic Sound for Motion Pictures.—M. Camras. (*J. Soc. Mot. Pict. Engrs*, Jan. 1947, Vol. 48, No. 1, pp. 14–24. Discussion, pp. 25–28.) Advantages and disadvantages of magnetic sound recording on motion picture film. High-quality recording apparatus is described and curves showing frequency response and distortion are given.

621.395.625.6 : 621.383.49 **1998**

The Use of Sulphur-Thallium Photocells in Sound Pictures.—Kolomiec. (*See* 2199.)

AERIALS AND TRANSMISSION LINES

621.392 + 537.291 **1999**

Study of the Simultaneous Propagation of a Guided Wave and of an Electron Beam of approximately Equal Velocity.—P. Lapostolle. (*C. R. Acad.*

Sci., Paris, 27th Jan. 1947, Vol. 224, No. 4, pp. 268–270.) For the system of a cylindrical guide formed of a dielectric of high permittivity, metallized on the outside and with an axial hole through which passes the electron beam, three waves are found to be propagated in the direction of the beam, one slightly faster than the beam and without change of amplitude, the others slightly slower, one increasing in amplitude and the other decreasing. See also 1317 and 1330 of May, and 2003 below.

621.392.029.64 **2000**

On Propagation in Curved Guides of Circular Cross-Section.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 549–551.) A summary of the results and conclusions of previous papers noted in 1320 of May and back references, 1005 of April and 1667 and 1668 of June.

621.392.029.64 + 621.396.611] : 621.384.6 **2001**

Cavities and Waveguides associated with Charged Particle Accelerators.—Kahan. (*See* 2200.)

621.392.029.64 : 535.231.2 **2002**

The "Black Body" for Radio Waves.—Malov. (*See* 2059.)

621.392.029.64: 621.385.029.64 **2003**

Study of the Various Progressive Guided Waves capable of Propagation in Interaction with an Electronic Beam.—P. Lapostolle. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 558–560.) An extension of the work described in 1999 above to the case where the electron velocity may have any value whatever. Only E_0 waves are considered. Certain waves are propagated with neither attenuation nor gain, others with either attenuation or gain. Conditions are given for the various possible types.

621.392.1 **2004**

Equations for Generalized Transmission Lines.—S. Frankel. (*Elect. Commun.*, Sept. 1946, Vol. 23, No. 3, pp. 329–331.) The differential equations for voltage and current at points not near discontinuities of a two-wire lossless line are extended to lossless lines consisting of a multiplicity of conductors of arbitrary cross-section.

621.392.2.025.3 **2005**

Propagation along an Electrically Long Symmetrical Three-Phase Line when a Transmitter is applied between One Phase and Earth.—A. Chevallier. (*C. R. Acad. Sci., Paris*, 17th July 1944, Vol. 219, No. 3, pp. 89–90.)

621.392.2.025.3 **2006**

Attenuation of High-Frequency Waves along an Electrically Long Symmetrical Three-Phase Line.—A. Chevallier. (*C. R. Acad. Sci., Paris*, 31st July, 1944, Vol. 219, No. 5, pp. 157–158.)

621.392.3 **2007**

Directional Couplers.—W. W. Mumford. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 160–165.) Describes the principles governing the independent measurement of the direct and reflected waves in an unmatched transmission line. The use of multi-element 'tapered-current' couplers is considered as a means of increasing the bandwidth. Application of the method to give a known attenuation and to enable power to be measured is also discussed.

621.392.4.08 : 621.397.5 : 621.396.67 **2008**

Application of Transmission Line Measurements to Television Antenna Design: Parts 1 & 2.—Hamilton & Olsen. (*See* 2262.)

621.392.5 **2009**

Spiral Delay Lines.—K. H. Zimmermann. (*Elect. Commun.*, Sept. 1946, Vol. 23, No. 3, pp. 327–328.) A brief discussion of design and applications with particular reference to the K-71 line which has a characteristic impedance of 950 Ω and a delay time of 0.042 μs/ft.

621.396.621.2 **2010**

Receiver Aerial Couplings for Medium Wavelengths.—S. W. Amos. (*J. Brit. Instn Radio Engrs*, July/Aug. 1946, Vol. 6, No. 4, pp. 144–161. Discussion, pp. 161–164.) A discussion of the electrical nature of an outdoor aerial and the problems arising when it is coupled to the aerial input circuit of a receiver. Equations and curves are given to show the variation of gain and selectivity with various types of aerial coupling. The two desirable features, high voltage transfer and high selectivity, are mutually conflicting, but it is possible to obtain 80% efficiency in gain and in selectivity at half optimum coupling.

Appendices give a detailed mathematical analysis of mutual inductance coupling, and a tabulation of exact and approximate formulae derived in the paper.

621.396.67 **2011**

The Antenna Laboratory.—(*Engng Exp. Sta. News*, Dec. 1946, Vol. 18, No. 5, pp. 3–24 & 33–40.) A series of papers describing successful war-time methods and equipment for testing the performance of airborne and other aerials by the use of scale models. The papers are entitled: The Antenna Laboratory, by E. E. Dreese. Miniature Antennas —A New Tool for the Antenna Designer, by G. Sinclair. Equipment for determining Aircraft Antenna Characteristics, by D. C. Cleckner. Simulation of the Characteristics of Direction Finder Antennas, by W. E. Rife. Accuracy of Antenna-Pattern Measurements, by R. A. Fouty. Construction of Models, by P. H. Nelson. Antennas Mounted on Vehicles [radiation pattern determined by model technique], by E. A. Jones.

621.396.67 **2012**

Recent Theories of the Aerial: Parts 1 & 2.—E. Roubine. (*Onde élect.*, Jan. & Feb. 1947, Vol. 27, Nos. 238 & 239, pp. 32–37 & 57–64.) An elementary treatment intended for non-specialists. To be continued.

621.396.67.011.2 **2013**

Note on the Expression for Mutual Impedance of Parallel Half-Wave Dipoles.—K. J. Affanasiev. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, p. 48.) Additional note to 23 of January.

621.396.674.011.2 **2014**

Special Aspects of Balanced Shielded Loops.—L. L. Libby. (*Elect. Commun.*, Sept. 1946, Vol. 23, No. 3, pp. 332–338.) Reprint of 25 of January.

621.396.677 **2015**

Metal Lenses for Radio.—"Cathode Ray". (*Wireless World*, March 1947, Vol. 53, No. 3, pp.

84–88.) A concise account of the properties and construction of the directive lenses designed at the Bell Telephone Laboratories. For a more detailed description see 1013 of April.

621.396.677 **2016**

Radiation Patterns of Ground-Based Antennas.—R. B. Jacques. (*Engng Exp. Sta. News*, Dec. 1946, Vol. 18, No. 5, pp. 24–33.) The output of the aerial to be tested was compared with that of an aerial of known pattern, using a moving airborne transmitter.

621.396.677 **2017**

Fundamental Beam Patterns.—D. C. Cleckner. (*QST*, March 1947, Vol. 31, No. 3, pp. 23–26.) A simplified method of plotting aerial characteristics.

621.392 **2018**

An Introduction to Transmission Lines. [Book Review]—C. J. Mitchell. Harrap & Co., London, 64 pp., 3s. 6d. (*Wireless World*, March 1947, Vol. 53, No. 3, p. 83.) A simple approach to the subject that " can be thoroughly recommended ".

CIRCUITS AND CIRCUIT ELEMENTS

537.525.72 : 621.396.6 **2019**

Electrodeless Discharges and Some Allied Problems.—G. I. Babat. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 27–37.) " Electrodeless discharges in high-frequency electromagnetic fields were investigated in conditions where the ratio of linear dimension l of the discharge space to the electromagnetic wavelength λ in air was $10^{-3} < l/\lambda < 10^{-1}$, at frequencies between 10^6 and 10^8 c/s. The power introduced into the discharge space varied from fractions of a watt to 100 kW, and the electric field strength was varied between tens and hundreds of volts per cm. There are two different types of discharge : ' E-discharges ' in which the elementary conductance currents are continued by dielectric currents, and ' H-discharges ', with elementary conductance currents in the form of closed curves."

537.533.7 **2020**

Interruption of Electron Beams.—P. Selme. (*C. R. Acad. Sci., Paris*, 26th June 1944, Vol. 218, No. 26, pp. 992–993.) A combination of two pentodes and two thyratrons giving establishment and suppression times which are negligible in comparison with the short exposure time.

538.244 + 621.3.013.1 **2021**

Theory of Ferromagnetic Inductances : Production and Use of Harmonics.—P. Bricout. (*Rev. gén. Élect.*, Feb. 1946, Vol. 55, No. 2, pp. 61–74.) A theory based on the method of representation of hysteresis cycles previously given (1746 of June). Tables and graphs permit rapid harmonic analysis of the current intensity. Practical methods are described of isolating odd harmonics and using them for local deformation of sinusoidal currents. This technique has proved useful in improving the operation of triphase dry or contact rectifiers.

621.3.078.3 **2022**

A Generalization of the Nyquist and Leonhard Stability Criteria.—W. Frey. (*Brown Boveri Rev.*, March 1946, Vol. 33, No. 3, pp. 59–65.) For Nyquist's rule for stability, see 1932 Abstracts, p. 279 ; for Leonhard's, see 567 of 1946. In the present paper, the underlying principles are considered mathematically ; the conditions under which the zeros of a function $f(z)$ of a complex variable z all have negative real parts are derived, where $f(z)$ has a finite number of poles of any order. A more general form of the Nyquist and Leonhard criteria is then deduced, whose application is not restricted to electric circuits.

621.314.3 **2023**

Some Considerations concerning the Internal Impedance of the Cathode Follower.—H. Goldberg. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 168–169.) Discussion of 42 of 1946.

621.316.722 **2024**

Regulator of Effective Alternating Voltage.—L. Le Blan. (*C. R. Acad. Sci., Paris*, 3rd March 1947, Vol. 224, No. 9, pp. 643–645.) A Wheatstone bridge has two opposite constant-resistance arms while the other two arms are fine nickel wires in vacuo. It is connected across the resistive load and balanced for a particular voltage. The out-of-balance voltage due to a change of the supply voltage is amplified and applied to the grids of a balanced triode system. The anodes of this system are fed from the two halves of a transformer secondary whose primary is included in one supply lead. The variation of the primary impedance acts as an automatic rheostat. Supply voltage variations are divided by a factor of the order of 1 000. A circuit diagram is given.

621.316.722.2 : 621.314.632 **2025**

Some Notes on the Copper-Oxide Rectifier and the Thermionic Tube in the Voltage-Doubling Circuit.—R. R. Gilmour. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 213–216.) Discusses the relative merits of the two rectifiers for a particular application requiring portability, 40 mA output into 500–5 000 Ω, ability to withstand short-circuits, and low ripple.

621.317.757 : 518.4 **2026**

Second Harmonic Calculator.—W. L. Detwiler. (*Communications*, Jan. 1947, Vol. 27, No. 1, pp. 16, 17..28.) Permits rapid graphical determination of harmonic distortion.

621.318.4 : 621.316.974 : 538.532 **2027**

The Field of a Coil between Two Parallel Metal Sheets.—Moullin. (*See* 2077.)

621.318.7 **2028**

Conditions for Common Frequencies in Ladder Networks, of Any Length, terminated by Identical Circuits differing from the Intermediate Circuits.—M. Parodi. (*C. R. Acad. Sci., Paris*, 19th June 1944, Vol. 218, No. 25, pp. 965–967.)

621.319.4 : 621.315.614.63 **2029**

Metallized Paper Capacitors.—J. I. Cornell. (*Communications*, Jan. 1947, Vol. 27, No. 1, p. 22.) A short account of self-healing capacitors produced by high vacuum vaporization of aluminium, the coatings being 25–100 mμ in thickness. Breakdown at a weak spot in the dielectric vaporizes the film there and re-deposits it as oxide, which is a good insulator. A non-inductive winding method is used for the larger capacitors, which are considerably smaller than those of similar value built from metal foil and paper. A 0.1-μF capacitor for a d.c. working voltage of 200 is only ⅝ inch long and ⅜ inch in diameter, while the corresponding metal-foil capacitor is approximately 1⅝ inch long and ½ inch in diameter. Summary of a Rochester Fall Meeting paper.

621.392 : 003.62 **2030**

Shorthand Circuit Symbols.—A. W. Keen. (*Wireless World*, March 1947, Vol. 53, No. 3, pp. 99–101.) Details of a simplified system, supplementary to existing practice, to save time in drawing circuit diagrams. It could be used with advantage to distinguish equivalent circuits from actual circuit diagrams.

621.392.4 **2031**

A Note on Phase Correction in Electrical Delay Networks.—A. J. Ferguson. (*Canad. J. Res.*, Jan. 1947, Vol. 25, Sec. A, No. 1, pp. 68–71.) By means of mutual inductance between the coils and capacitance across them, the third and fifth order terms in the expression for the variation of phase shift with frequency can be eliminated. A simple relation between the circuit constants is found for this case.

621.392.5 **2032**

Geometrical Considerations in connection with the Theory of Electric Four Terminal Networks. [Thesis]—J. van Slooten. N. V. Philips' Gloeilampenfabrieken Research Laboratory, Eindhoven. Reprints are available. (*Philips tech. Rev.*, Sept. 1946, Vol. 8, No. 9, p. 287.) The first part discusses the properties of quadripoles as impedance transformers. The second gives methods of determining the characteristics of the resultant quadripole obtained by connecting in series or parallel two lossless quadripoles whose transformer properties are known. A Cayley diagram is given for the series connexion. Brief summary only.

621.392.52.011.2 **2033**

The Direct Setting-Up of $Z_{\alpha\beta}$ for Closed-Mesh Networks from the Network Diagram : Part 1.—S. A. Stigant. (*Beama J.*, Jan. 1947, Vol. 54, No. 115, pp. 28–36.) The impedance tensor, $Z_{\alpha\beta}$, of a mesh network can be written down directly in full detail from the network diagram. The $\alpha\beta$ axes may be either loop or branch currents. In the present article loop currents are considered. To be continued.

621.392.52.015.33 **2034**

Transition Time and Pass Band.—C. C. Eaglesfield. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 166–167.) Fourier transforms are used to define two functions which may be regarded as definitions of pass band and transition time for a network subjected to a step function voltage. The numerical relation between these functions is that usually quoted, but this approach avoids the ' ideal filter '.

621.392.52.015.33 **2035**

Transient Response of Filters.—V. Belevitch : W. E. Thomson. (*Wireless Engr*, March 1947, Vol. 24, No. 282, pp. 93–94.) Criticisms of a statement in a letter by E. T. Emms (662 of March) that when a voltage $\cos\omega_0 t.\mathbf{1}$ is applied to a band-pass filter the envelope of the output transient is the same as the output voltage produced by a unit step in the equivalent low-pass filter. This statement is shown to be untrue in general, being valid only for a narrow-band filter.

621.394/.397].645 **2036**

Capacitance - Coupled Intermediate - Frequency Amplifiers.—M. J. Larsen & L. L. Merrill. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, pp. 71–74.) Discusses the design and performance of attenuating traps for television i.f. amplifiers above 20 Mc/s, using double-ended damping to minimize changes in response due to component variations.

621.394/.397].645.3 **2037**

Cathode-Excited Linear Amplifiers.—J. J. Muller. (*Elect. Commun.*, Sept. 1946, Vol. 23, No. 3, pp. 297–305.) The advantages of cathode-excited power amplifiers are outlined. " The use of neutralizing capacitances having values which differ from the internal capacitances of the vacuum tubes, in combination with appropriate reactances between the grids of symmetrical stages, permits control of power amplification, stability and feedback." The distortion characteristics of a cathode-excited stage are illustrated by reference to intermodulation measurements made on a 60-kW two-channel transmitter.

621.395/.396].645.36 **2038**

The Twin Triode Phase-Splitting Amplifier.—J. D. Clare. (*Electronic Engng*, Feb. 1947, Vol. 19, No. 228, pp. 62–63.) A practical circuit modification used to operate the twin triodes under optimum conditions and to give a flat ' gain/frequency ' response over a very wide audio band.

621.396.611.1 : 621.316.5 **2039**

The Energy Output of an Oscillatory Circuit excited by a Periodically Interrupted Continuous Current.—J. Cayrel. (*C. R. Acad. Sci., Paris*, 17th Jan. 1944, Vol. 218, No. 3, pp. 109–111.) Experiments show that when a mercury interrupter is used, the output efficiency approximates to 100%, proving that the current break occurs in a time very short with respect to the natural frequency of the oscillatory circuit. Interrupters with solid contacts gave anomalous results.

621.396.611.4 : 534.2 **2040**

New Method for Calculating the Properties of Electromagnetic Resonators.—P. Grivet. (*C. R. Acad. Sci., Paris*, 10th Jan. 1944, Vol. 218, No. 2, pp. 71–73.) An adaptation to the case of electric vibrations of Rayleigh's method for mechanical vibrations. For applications of this method see 2041 below.

621.396.611.4 : 534.2 **2041**

The Natural Wavelength of Certain Electromagnetic Resonators.—P. Grivet. (*C. R. Acad. Sci., Paris*, 31st Jan. 1944, Vol. 218, No. 5, pp. 183–185.) The method described in 2040 above is applied to calculate the natural wavelengths of a cylinder, a ring of rectangular section, a rhumbatron and a sphere.

621.396.615 **2042**

The Calculation of Triode Oscillators.—J Queffelec. (*C. R. Acad. Sci., Paris*, 6th Nov. 1944 Vol. 219, No. 18, pp. 449–451.) Calculation base,. on the assumptions that the triode operates we d below saturation, that the characteristic is linear and that grid current is negligible.

621.396.615.14 : 621.385.029.63/.64 **2043**
The Traveling-Wave Tube as Amplifier at Microwaves.—Kompfner. (*See* 2286.)

621.396.615.142 **2044**
A Wide-Tuning-Range Microwave Oscillator Tube.—Clark & Samuel. (*See* 2291.)

621.396.615.142 **2045**
Transit-Time Effects in Ultra-High-Frequency Class-C Operation.—Dow. (*See* 2290.)

621.396.645 **2046**
Cathode-Coupled Triode Amplifiers.—N. I. Korman. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, p. 48.) Comment on 3811 of 1945 (Sziklai & Schroeder).

621.396.645 : 621.318.572 **2047**
Photo-Counters and Poisson's Law.—A. Blanc-Lapierre. (*C. R. Acad. Sci., Paris*, 31st Jan. 1944, Vol. 218, No. 5, pp. 188–190.) A study of the output fluctuations of an amplifier excited by equal, short, and random impulses of low density. The series of discharges of a photo-counter can be satisfactorily used, and Poisson's law is in general obeyed. For high densities, see 2048 below.

621.396.645 : 621.38 **2048**
Shot Effect and Fluctuations at the Output of a Linear Amplifier.—A. Blanc-Lapierre. (*C. R. Acad. Sci., Paris*, 14th Feb. 1944, Vol. 218, No. 7, pp. 272–274.) Extension of 2047 above to high impulse densities, using a photoelectric multiplier tube instead of a photo-counter. Two formulae are given from which the output law for any input density may be deduced ; the limiting form of this law as the density increases indefinitely is Gaussian.

621.396.645.36 **2049**
Push-Pull Amplifier with Direct Coupling.—S. Petralia & R. Ricamo. (*Nuovo Cim.*, 1st June 1946, Vol. 3, No. 3, pp. 185–197. In Italian with English summary.) A battery-fed push-pull amplifier with linear frequency response to 6 000 c/s and gain of the order of 1.5×10^6. The output is connected to a c.r.o. Drift is low after 5 minutes' operation.

621.396.645.371 **2050**
The Anode Follower.—B. H. Briggs. (*R.S.G.B. Bull.*, March 1947, Vol. 22, No. 9, pp. 138–143.) A full account of the properties of a circuit in which negative feedback is applied to a single valve amplifier. Practical details of design are given, with several applications.

621.396.645.371.029.4 **2051**
The Parallel-T Bridge Amplifier.—A. B. Hillan. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 42–51.) A discussion on the design and performance of low-frequency amplifiers using negative feedback through a parallel-T bridge network to obtain selectivity. " Two basic forms of the circuit giving symmetrical selectivity are analysed, and a method of varying the selectivity while maintaining the magnitude and frequency of the peak amplification constant is indicated."

621.396.662.2 **2052**
Guillotine Tuner for F.M.—(*Electronics*, Feb. 1947, Vol. 20, No. 2, p. 136.) A variable inductance tuning system in which a blade is inserted between the turns of a two-turn coil to change their self-inductance and mutual inductance.

621.396.662.34.029.3 **2053**
An RC Audio-Frequency Filter.—P. N. Nield. (*R.S.G.B. Bull.*, March 1947, Vol. 22, No. 9, pp. 144–145.) A ladder-type filter with a pass band centred usually at about 1 000 c/s.

621.39.09 **2054**
Electrical Transmission in Steady State. [Book Review]—P. J. Selgin. McGraw-Hill Book Co., New York, 427 pp., $5.00. (*Communications*, Jan. 1947, Vol. 27, No. 1, p. 33.) Fundamental circuit, field and network principles, with detailed analysis of circuit characteristics. Field theory and Maxwell's equations are considered for u.h.f., where lumped circuit concepts cease to apply, and coupled circuits and three-conductor systems are studied.

621.396.69 **2055**
Radio Components for Export. [Book Review]—Radio Component Manufacturers' Federation, London. (*Elect. Times*, 13th Feb. 1947, Vol. 111, No. 2886, p. 211.) A new catalogue giving a comprehensive survey of the products of leading British firms. Printed in English, French, and Spanish.

GENERAL PHYSICS

534.213 **2056**
Propagation of Plane Elastic Waves in a Heterogeneous Medium.—M. Parodi. (*C. R. Acad. Sci., Paris*, 10th Jan. 1944, Vol. 218, No. 2, pp. 69–71.) The propagation of such waves in an infinite heterogeneous medium satisfies the quadripole equation. The case of propagation along an arbitrary line was discussed in 2149 of 1944.

534.213 : 548.0 : 537 **2057**
Propagation of Elastic Waves in a Piezoelectric Medium.—M. Cotte. (*C. R. Acad. Sci., Paris*, 13th March 1944, Vol. 218, No. 11, pp. 445–447.)

535.13 **2058**
On the Ellipsoidal Theory of Wave Propagation [liaisons ondulatoires].—J. Dreyfus-Graf. (*Helv. phys. Acta*, 18th Dec. 1946, Vol. 19, Nos. 6/7, pp. 399–404. In French.) A new theory based on the principles of Fermat, of Huyghens and of superposition, leads to the replacement of the Poynting energy vector by an ellipsoid with foci at the transmitter and receiver (ellipsoïde de liaison). This enables the problem of diffraction of a spherical wave front to be solved by elementary mathematics. For the case of diffraction by an absorbing screen, the new theory gives much simpler formulae than the Fresnel integrals. If this theory is correct, all the classical theories based on that of Maxwell involve a fundamental phase error of 45°. Correction of this error is necessary for the solution of problems such as that of the diffraction of a spherical wave front at the edge of a screen. The hope is expressed that competent critics will comment on the new theory.

535.231.2 : 621.392.029.64 **2059**

The "Black Body" for Radio Waves.—N. Malov. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 4, pp. 383–385.) Southworth has indicated that in order to obtain a pure travelling wave in a waveguide closed by a metallic piston, a slightly absorbing plate should be placed in front of the piston. This plate together with the space between it and the piston acts as a 'black body'. This gives a new method (for which formulae are derived) for investigating the electrical properties of materials at v.h.f. See also *Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 495–498 (in Russian).

535.329-15 : 535.81 **2060**

Dispersion of Several Optical Glasses in the Near Infra-Red.—J. Ramadier. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 555–557.)

535.33.072-15 : 539.2 **2061**

Infra-Red Spectrographic Study of Molecular Groups.—J. Lecomte, G. Champetier & P. Clément. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 553–555.)

535.376 **2062**

Cathodo-Luminescence.—A. V. Moskvin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 429–462. In Russian.) The most important properties of substances which become luminescent when excited by an electron beam are discussed and a number of experimental curves are given. A theoretical interpretation of the phenomenon is offered.

535.376 **2063**

On Cathodo-Luminescence of Solid Phosphors.—E. A. Ab. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 467–468. In Russian.) Experiments were conducted with $CaWO_4$, Zn_2SiO_4Mn and ZnB_4O_7Mn. Curves are plotted showing the spectral distribution of radiation and the effect of temperature on the performance of these substances.

537.291 **2064**

The Motion of Positive Ions in the Electric Field in a Gas.—L. Sena. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 8, pp. 734–738. In Russian.) An English version was noted in 1405 of May.

537.523.4 **2065**

The Strong Current Stage of an Electric Spark in a Gas at Atmospheric Pressure. Parts 1 & 2.—I. S. Marshak. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 8, pp. 703–717 & 718–727. In Russian, with English summary.) Current/time and voltage/time curves calculated from energy considerations are obtained. The nature of the limitation of current density increase at a later stage of the discharge is explained.

537.525 **2066**

On the Oscillation of the Electron Plasma.—L. Landon. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 7, pp. 574–586. In Russian.) Equations are derived determining the oscillations arising in a plasma owing to the initial unbalanced distribution of electrons. It is shown that these oscillations decrease with time. The penetration of an external oscillating field into the plasma is also considered.

537.525.5 **2067**

Spontaneous Electrical Oscillations in Low-Pressure Arc Discharge.—B. Granovsky & L. Bykhovskaya. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 4, pp. 351–359.) Four different modes of oscillation depend upon discharge conditions and especially upon whether the cathode spot is free or anchored. Graphs show the dependence of the frequency and peak amplitude of these oscillations upon pressure, current and arc length.

537.525.5 **2068**

Rate of Growth of Current in Arc Discharges.—K. D. Froome. (*Nature, Lond.*, 25th Jan. 1947, Vol. 159, No. 4030, p. 129.) Discusses the characteristics of the high-intensity short-duration type of discharge through small gas tubes. A fuller account will be published later.

537.531 : 535.341 **2069**

Measurement of X-Ray Absorption Coefficients.—J. Devaux & A. Guinier. (*C. R. Acad. Sci., Paris*, 21st Feb. 1944, Vol. 218, No. 8, pp. 318–320.) A monochromatic beam passes successfully through two ionization chambers to which voltages of opposite sign are applied. These chambers are separated by the absorbing material; the first has low sensitivity which is controlled by the displacement of a screen, with micrometer adjustment, in front of the collecting electrode. In equilibrium the ionization currents in the two chambers are equal and opposite. The apparatus is calibrated by noting the micrometer reading corresponding to absorbing material of known composition and thickness. A thickness variation of $1\,\mu$ in sheet aluminium 0.25 mm thick causes a galvanometer spot deflexion of 4 cm.

537.533.9 : 778.3 **2070**

A New Method for Studying the Mechanism of the Photographic Action of Electrons.—P. Selme. (*C. R. Acad. Sci., Paris*, 10th July 1944, Vol. 219, No. 2, pp. 60–62.)

537.562 : 551.510.535 **2071**

On the Mean Energy of Electrons released in the Ionization of Gas.—G. Drukarev. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 483–488. In Russian, with English summary.) As an electron released by ionization gives up its energy during a large number of collisions, the mean energy of the electrons is larger, under certain conditions, than the thermal energy of the remainder of the gas. The conditions under which the electrons may be regarded as a gas having a temperature are considered; a formula for this temperature is derived, and applied to the ionosphere. An English version appears in *J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 81–84.

538.114 : 539.23/24 **2072**

Theory of the Structure of Ferromagnetic Domains in Films and Small Particles.—C. Kittel. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 965–971.) Discussion of "the theory of the domain structure of ferromagnetic bodies whose smallest dimension is comparable with the thickness of the Weiss domains as found in crystals of ordinary size".

538.22 **2073**

Thermo-Remanence and the Theory of Metamagnetism.—É. Thellier. (*C. R. Acad. Sci., Paris*, 12th Aug. 1946, Vol. 223, No. 7, pp. 319–321.) Recent researches on the thermo-remanence of $Fe_2O_3\alpha$ and certain baked earths show that these substances are metamagnetic; i.e., paramagnetic and ferromagnetic simultaneously. The essential characteristics of this condition are described by J. Becquerel (Congrès de Strasbourg, 1939, Le Magnétisme, Vol. 1, pp. 97–139; see 3597 of 1946). Three important differences are noted between isothermal remanence and thermo-remanence; theory must allow for these.

538.221 **2074**

On the Exchange Interaction of the Valence and Inner Electrons in Ferromagnetic (Transition) Metals.—S. Vonsovsky. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 5, pp. 468–475.)

538.245 **2075**

On the Connection between the Magnetization and Hysteresis Curves of Polycrystalline Ferromagnetic Bodies.—N. Poptzov & L. Tchernikova. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 513–522. In Russian, with English summary.) The connexion is considered between the magnetization and hysteresis curves of soft polycrystalline ferromagnetic substances having a small degree of magnetic anisotropy, such as permalloy and alsifer. Specimens of polycrystalline cobalt were also examined.

The experimental hysteresis curves agree with theoretical curves computed from E. Kondorsky's formula (591 of 1944) over the whole range of magnetic field values from zero to the coercive force of the specimen concerned. An English version appears in *J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 85–91.

538.245 : 539.185.9 **2076**

Neutron Polarization and Ferromagnetic Saturation.—F. Bloch, R. I. Condit & H. H. Staub. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 972–973.)

538.532 : 621.316.974 : 621.318.4 **2077**

The Field of a Coil between Two Parallel Metal Sheets.—E. B. Moullin. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 78–84.) An investigation of the problem of a circular coil of any radius with its plane parallel to two infinite and perfectly conducting planes separated by any distance. The exact expression for the field when the sheets are close together is derived, giving the absolute calibration for an 'attenuator' of this type. The results obtained are applicable to the case of a coil enclosed in a cylindrical screening can with closed ends. See also 821 of 1941.

538.56 : 535.42 **2078**

On a Problem of Diffraction of Electromagnetic Waves at the Surface of Separation of Two Media.—L. Robin. (*C. R. Acad. Sci., Paris*, 24th Jan. 1944, Vol. 218, No. 4, pp. 135–136.) A treatment of the case of an infinite diffracting plane. The solution is not limited to sinusoidal functions of the time; the two media are conductors and the scalar equation of propagation of spherical waves is valid. See also 2079 below.

538.56 : 535.42 **2079**

A Problem of Propagation and of the Diffraction of Electromagnetic Waves at the Surface of Separation of Two Media.—L. Robin. (*C. R. Acad. Sci., Paris*, 26th June 1944, Vol. 218, No. 26, pp. 989–990.) An application of Maxwell's equations to the case treated in 2078 above.

538.56 : 535.421 **2080**

On a Theorem in the Theory of Diffraction and Its Application to Diffraction by a Narrow Slit of Arbitrary Length.—M. Leontovich. (*Zh. eksp. teor. Fiz.*, 1946, Vol. 16, No. 6, pp. 474–479.) In Russian, with English summary.) The problem of a plane e.m. wave incident on a thin plane perfectly conducting screen with an aperture of arbitrary shape can be reduced to that of a similar wave incident on a perfectly reflecting lamina of the same shape as the aperture. In the special case of a narrow slot, it can be solved completely.

538.566 **2081**

The Field of a Plane Wave near the Surface of a Conducting Body.—V. Fock. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 5, pp. 399–409.) Expressions are derived for the field at any point on or near the surface of a convex body of finite conductivity. From a knowledge of the distribution of the currents induced by an incident plane wave, an approximate solution can be obtained for the case of diffraction by a conducting convex body of arbitrary shape.

538.691 : 531.553 **2082**

The Hodoscope.—J. Loeb. (*Onde élect.*, Jan. 1947, Vol. 27, No. 238, pp. 27–31.) A discussion of the principles and possible applications of an instrument by means of which the trajectory of an electrified particle in a stationary magnetic field can be traced without calculation.

541.183.26 : 621.352.36.011.2 **2083**

The Effect of Physical Adsorption on the Electrical Resistance of Activated Carbon.—R. McIntosh, R. S. Haines & G. C. Benson. (*J. chem. Phys.*, Jan. 1947, Vol. 15, No. 1, pp. 17–27.) Measurements of resistance changes due to adsorption of various vapours.

537.228.1 **2084**

Piezoelectricity. [Book Review]—W. G. Cady. McGraw-Hill Book Co., New York & London, 806 pp., $9.00 or 45s. (*Elect. Rev., Lond.*, 20th Dec. 1946, Vol. 139, No. 3604, p. 1028; *J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1130–1131.) A detailed survey of the whole domain of crystal physics that centres round piezoelectricity. "To the mature physicist and serious research student the work will be invaluable. . . . The technical applications are only treated insofar as they illustrate the scientific side of the subject."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.5 : 621.396.82 **2085**

The Giacobinid Meteor Shower, 1946.—J. S. Hey. (*Nature, Lond.*, 25th Jan. 1947, Vol. 159, No. 4030, pp. 119–121.) A more detailed account of the observations discussed in 1753 of June.

523.53 **2086**

Derivation of Meteor Stream Radiants by Radio Reflexion Methods.—J. S. Hey & G. S. Stewart. (*Nature, Lond.*, 5th Oct. 1946, Vol. 158, No. 4014, pp. 481–482.) With 150-kW peak power on vertical pulse transmissions (λ 4–5 m), definite correlation is found between echo reception peaks and the Quadrantid and Lyrid meteor showers in January and April 1946. The echoing source is sensitive to aspect and a technique is described whereby the activity and radiant directions of the main meteor streams can be observed both by day and by night in all weathers.

523.7 : 621.396.822.029.62 **2087**

On the Radio-Frequency Emission from the Sun : Part 1.—J. V. Garwick. (*C. R. Acad. Sci., Paris*, 10th Feb. 1947, Vol. 224, No. 6, pp. 377–379.) Deductions from the hypothesis attributing the emissions to the rotation of electrons round the lines of force of a magnetic field H are discussed and compared with Appleton's results (323 of 1946). Agreement between the theoretical and experimental curves indicates that for wavelengths above 5 m the radiation intensity is proportional to $H^{\frac{1}{2}}$. Possible explanations are suggested for the discrepancies between theory and experiment for wavelengths from 2 m to 5 m. For part 2 see 1758 of June.

523.72 : 621.396.822 **2088**

Origin of Radio Emissions from the Disturbed Sun.—D. F. Martyn. (*Nature, Lond.*, 4th Jan. 1947, Vol. 159, No. 4027, pp. 26–27.) A theory accounting for solar radio emissions associated with sunspots. Radiation may occur by virtue of an 'extraordinary' mode of oscillation of the ionized gases above the chromosphere.

523.745 : 550.384 **2089**

Relations between Solar Activity and Fluctuations in the Magnetic Declination at Lyons.—J. Dufay & P. Flajolet. (*C. R. Acad. Sci., Paris*, 4th Jan. 1944, Vol. 218, No. 1, pp. 46–48.) A graph of the mean amplitude A of declination fluctuations and the Wolf-Wolfer relative number S for sunspot activity for the years from 1884 to 1933 gives a correlation coefficient between A and S of + 0.45 for the decreasing phase and of + 0.76 for the increasing phase. At Paris, Brazier has found, for the years 1884 to 1917, a mean value of +0.33. See also 2090 below.

523.745 : 550.384 **2090**

The Annual Variation of the Magnetic Declination Fluctuations at Lyons and Its Relations with Solar Activity.—J. Dufay & P. Flajolet. (*C. R. Acad. Sci., Paris*, 24th Jan. 1944, Vol. 218, No. 4, pp. 162–164.) Detailed analysis of the data for the period 1884–1933 confirms the results of Kostitzin regarding the retardation of the autumn maximum and its large amplitude during the increasing phase of solar activity. During the decreasing phase, on the contrary, there is a tendency for the maxima to be displaced in the opposite sense and the spring maximum becomes the more important. This can be attributed to two causes : (*a*) solar activity generally increases more rapidly than it decreases ; (*b*) the progressive diminution of the latitude of the sunspots during the cycle makes them more and more effective. See also 2089 above.

523.746 **2091**

Structure of Sunspots.—G. J. Odgers. (*Mon. Not. R. astr. Soc.*, Vol. 106, No. 2, pp. 101–107.) " The possibility that a sunspot is merely a region in which the product of the absorption coefficient and the density is higher than that of the disk is examined." Solution of the equations of radiative equilibrium shows that the observed contrast between spot and disk can be explained by increased density inside the spot. Other features of spots are explained similarly.

2092

523.78 " 1945.07.09 " : 621.396.812 : 551.510.535

Radio Observations during the Solar Eclipse of 9th July 1945.—N. D. Papalexi. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 3, pp. 237–242. In Russian.) The following preliminary conclusions were obtained from a general survey of the observations : (*a*) The predominant role of the ultra-violet radiation from the sun in the ionization of all layers of the ionosphere is confirmed. (*b*) The density of the ionization of the F_2 layer diminished by 20 – 30% of the average value some 40 – 50 minutes after totality. (*c*) During the photon eclipse the direction of the signals reflected from the F_2 layer was altered, which indicates curvature of this layer. (*d*) During the period corresponding to the corpuscular eclipse for particles with velocities of the order of 500 km/sec peculiar perturbation effects were observed in the state of ionization of the whole depth of the ionosphere from the F_2 layer to the E layer.

2093

523.78 " 1945.07.09 " : 621.396.812 : 551.510.535

On Radio Observations during the Solar Eclipse of 9th July 1945.—Ya. L. Al'pert & B. N. Gorozhankin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 3, pp. 245–251. In Russian.) Observations were carried out near Moscow to determine the effects of the ultra-violet and corpuscular radiations from the sun on the ionization of the upper layers of the atmosphere and to investigate the possible curving of the reflecting regions of the ionosphere during the photon eclipse.

The main results were : (*a*) It was confirmed that the ultra-violet radiation from the sun determines the ionization of the E layer. The measured azimuth values of reflections from the F_2 layer are consistent with the assumption that a certain curvature of the layer takes place during the ultra-violet eclipse of the sun. (*b*) The ionosphere appears to be affected by the corpuscular radiation from the sun and in particular by particles with velocities of 400–600 km/sec.

2094

523.78 " 1945.07.09 " : 621.396.812 : 551.510.535

On the Results Obtained in the Investigation of the Ionosphere during the Solar Eclipse of 9th July 1945.—A. N. Kazantseff. (*Bull. Acad. Sci. U.R.S.S., sér., phys.*, 1946, Vol 10, No. 3, pp. 261–267. In Russian.) Observations were made at a temporary ionosphere station near Leningrad. The field intensities of the Leningrad and Kuibisheff radiotelephone stations (at frequencies of the order of 7 Mc/s) were also compared at this point.

The observations have confirmed the predominant role of the ultra-violet radiation from the sun in the ionization of the ionosphere. Thus, an abrupt diminution of the absorption and therefore of the ionization of the lower layers was observed during the optical eclipse, together with a decrease in the ionization of the F region. The effects of the corpuscular eclipse were much less obvious, but the gradual increase in the field intensity two hours before the eclipse was probably due to the corpuscular eclipse for fast particles, in accordance with Milne's calculations.

523.78 " 1945.07.09 " : 621.396.812.029.62/.63 **2095**

Observations of the Ultra-Short Wave Propagation during the Solar Eclipse of 9th July 1945.—N. I. Kabanoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 3, pp. 275–278. In Russian.) Army radar stations were used for observing signals reflected from obstacles such as hills, tall buildings or masts. Observations were carried out at hundreds of places in the zone of the eclipse over distances up to several tens of kilometres. The main preliminary conclusions reached from a statistical analysis of the data are as follows: during the total eclipse an increase of 15 – 20% in signal amplitude was observed for distances of 20 – 60 km at decametre and metre wavelengths, but for distances of 15–20 km the corresponding increase was much smaller; no increase was observed for distances of 2–10 km at metre and decimetre wavelengths.

523.78 " 1945.07.09 " : 621.396.812.029.62 **2096**

Observations of the Variations of the Ultra Short Wave Intensity during the Solar Eclipse of 9th July 1945.—N. V. Osipoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 3, pp. 281–284. In Russian.) Observations were carried out at wavelengths of 1.44 m and 4.00 m over a distance of 55 km due south of Moscow. Preliminary studies were made during the six months preceding the eclipse. During the eclipse the expected increase in the field intensity was observed, accompanied by rather strong fading. The maximum field intensity did not quite coincide with totality; this was probably due to the presence of the fading. It was thus established that during the eclipse the conditions of radio transmission approached for a short period those prevailing at night.

535·338.4 : 551·593.9 **2097**

A New Method of Molecular Spectrum Analysis with Application to the Spectrum of the Night Sky.—D. Barbier. (*C. R. Acad. Sci., Paris*, 10th Feb. 1947, Vol. 224, No. 6, pp. 385–397.)

537·591 **2098**

Showers of Mesotrons and of Slow Particles.—J. Daudin. (*C. R. Acad. Sci., Paris*, 31st Jan. 1944, Vol. 218, No. 5, pp. 192–193.) Apparatus for observation comprises three counters in a mass of lead and a Wilson chamber with lead partition. Results are discussed. For further results see 2099 below.

537·591 **2099**

Showers of Mesotrons and of Slow Particles.—J. Daudin. (*C. R. Acad. Sci., Paris*, 14th Feb. 1944, Vol. 218, No. 7, pp. 275–276.) A discussion of further results obtained with the apparatus described in 2098 above.

537·591 **2100**

Probable Existence of a Particle of Mass 990 m_0 in Cosmic Radiation.—L. Leprince-Ringuet & M. Lhéritier. (*C. R. Acad. Sci., Paris*, 13th Dec. 1944, Vol. 219, No. 23, pp. 618–620.)

537·591 **2101**

Some Mesotron Observations by Simultaneous Registration at Two Stations.—F. A. Benedetto. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 817–820.) Mean life range near sea level was estimated at 9.7 ± 3 km. By correlating ground values of mesotron intensity with variations in the heights at which pressures from 1 000 to 100 mb occur, it is inferred that two production levels for mesotrons exist at approximately 5.5 and 16 km.

537·591 **2102**

Multiple Scattering and the Mass of the Meson.—H. A. Bethe. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 821–831.) Multiple scattering by the atoms of the gas in a cloud chamber can cause large apparent curvature of tracks. An analysis shows that all published meson tracks are compatible with a unique mass of about 200 electron masses. See also 1428 and 1429 of May.

537·591 **2103**

On the Fine Structure of Zenithal Curves of the Cosmic Radiation.—G. Cocconi & V. Tongiorgi. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 850–852.)

537·591 **2104**

The Mean Lifetime of the Meson.—G. Cocconi & V. Tongiorgi. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 855–859.)

537·591 **2105**

On the Mean Life of Slow Mesons.—M. Conversi & O. Piccioni. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 859–873.)

537·591 **2106**

On the Disintegration of Slow Mesons.—M. Conversi & O. Piccioni. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 874–881.)

537·591 **2107**

A Note on the Proton Hypothesis of the Primary Component of Cosmic Rays.—N. Arley. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 975–976.)

537·591.15 **2108**

The Density Spectrum of the Extensive Cosmic-Ray Showers of the Air.—G. Cocconi, A. Loverdo & V. Tongiorgi. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 841–846.)

537·591.15 **2109**

Experimental and Theoretical Evaluation of the Density Spectrum of Extensive Cosmic-Ray Showers. G. Cocconi, A. Loverdo & V. Tongiorgi. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 846–849.)

537·591.15 **2110**

Penetrating Particles in Air Showers.—G. Cocconi, A. Loverdo & V. Tongiorgi. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 852–854.)

537·591.15 **2111**

The Density Spectrum and the Origin of Extensive Atmospheric Cosmic-Ray Showers.—G. Cocconi. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, p. 975.)

537.591.15 **2112**

The Main Results Obtained by the Pamir Expedition for the Investigation of Cosmic Rays.—D. V. Skobel'tsyn. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, No. 3, pp. 250–258. In Russian.) A brief report on the work of the expedition whose main task was the investigation of showers and nuclear fission at a height of about 3 800 m. See also 1441 of May.

537.591.15 **2113**

The Problem of Fluctuations in Cosmic Radiation Showers.—M. Della Corte. (*Nuovo Cim.*, 1st June 1946, Vol. 3, No. 3, pp. 142–151. In Italian, with English summary.)

538.566.3 **2114**

Measurements of Changes of the Phase-Paths of Radio Waves in the Ionosphere.—J. W. Findlay. (*Nature, Lond.*, 11th Jan. 1947, Vol. 159, No. 4028, pp. 58–59.) A modification of the pulse method is described whereby both the magnitude and the sense of a change of phase-path can be determined. The method was used to study the changes of phase-path of pulses reflected from the E and F layers, using wavelengths of 150 and 75 m. On 20 occasions during observations of the E layer Dellinger fade-outs occurred, their start being marked by a rapid reduction of phase-path, of the order of 1 km, in about a minute. The recovery of the echo corresponded to a slower increase of phase-path. The results are discussed and possible explanations given.

538.7 + [523.7 : 538 **2115**

A Theoretical Interpretation of Terrestrial and Solar Magnetism.—J. Mariani. (*C. R. Acad. Sci., Paris*, 3rd April 1944, Vol. 218, No. 14, pp. 585–586.) A new geometrical interpretation based on a Riemann torsion space.

551.508.19 **2116**

Pressure and Temperature Measurements in the Upper Atmosphere.—N. R. Best, E. Durand, D. I. Gale & R. J. Havens. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, p. 985.) A description of experiments using a V2 rocket in New Mexico. Measurements were made up to 90 km above sea level.

551.510.535 + 523.746 + 621.396.812 **2117**

Ionosphere Review.—T. W. Bennington. (*Wireless World*, March 1947, Vol. 53, No. 3, pp. 108–111.) A discussion of the correlation between solar activity and ionosphere effects, with predicted sunspot numbers to 1951 and details of working frequencies for radio transmission during 1947.

551.510.535 : 537.562 **2118**

On the Mean Energy of Electrons released in the Ionization of Gas.—Drukarev. (*See* 2071.)

551.593.9 **2119**

Altitude of Emission of the Light of the Night Sky.—P. Abadie, É. Vassy & Mme. É. Vassy. (*C. R. Acad. Sci., Paris*, 24th Jan. 1944, Vol. 218, No. 4, pp. 164–166.) The results obtained at the Pic du Midi can be explained by the assumption of two thin emitting layers, one at a height of 900 to 1 000 km and another at 65 to 70 km, the zenith emission of the lower layer being slightly the weaker. A single thin or thick layer will not explain the results.

551.594.12 **2120**

Ionic Equilibrium in the Lower Atmosphere.—J. Gilbert. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 584–587.) Discussion of the results of various investigators shows that (*a*) the equilibrium relations of Gish and Sherman are applicable if account is taken, apart from Aitken nuclei, of centres not acting as condensation nuclei; (*b*) the number of supplementary centres at Chambon is sensibly constant (about 30 000); and (*c*) the number of centres at Paris is much higher in winter than in summer.

551.594.21 : 539.16.08 **2121**

On the Application of Wilson's Mechanism to Thunder-Clouds.—J. Bricard. (*C. R. Acad. Sci., Paris*, 17th Feb. 1947, Vol. 224, No. 7, pp. 487–489.) The presence in the cloud of large particles and the operation of Wilson's mechanism can account for the local field increments responsible for luminous discharges.

551.594.6 : 523.746.5 **2122**

Ionospheric Fluctuations of Sudden Origin and the Eleven-Year Solar Cycle.—R. Bureau. (*C. R. Acad. Sci., Paris*, 6th Nov. 1944, Vol. 219, No. 18, pp. 461–463.) Observations from 1930 to 1944 of sudden increases of the mean level of atmospherics on a wavelength of 11 000 m, show a close connexion between the frequency of their occurrence and the changes of solar activity. Both curves show the eleven-year cycle, with no phase difference.

551.594.6 : 621.39.029 **2123**

Effect of Wavelength on the General Level of Atmospherics.—R. Bureau. (*C. R. Acad. Sci., Paris*, 9th Oct. 1944, Vol. 219, No. 14, pp. 349–351.) Automatic recording of atmospherics on wavelengths from 25 000 m to 115 m and observations on shorter waves (85 m to 20 m) show that the range of sources of atmospherics decreases from over 3 000 km for 25 000-m waves to about 46 km for 26-m waves. Special features of the effects observed on the shorter waves are discussed and also a crevasse sometimes found in the atmospherics curve for 11 000 m wavelength.

537.591 **2124**

Les Rayons Cosmiques : Les Mésotons. [Book Review]—L. Leprince-Ringuet. Editions Albin Michel, Paris, 373 pp., 330 fr. (*Rev. sci., Paris*, 15th Oct. 1946, Vol. 84, No. 3259, pp. 432–433.)

LOCATION AND AIDS TO NAVIGATION

621.396.824 **2125**

Lateral Deviation of Radio Waves at Sunrise.—W. Ross & E. N. Bramley. (*Nature, Lond.*, 25th Jan. 1947, Vol. 159, No. 4030, p. 132.) An account of observations made at Slough on the 6.05-Mc/s B.B.C. transmitter in Cumberland during April and May 1946, the sunrise line being then approximately along the transmission path. "The bearings immediately following the maximum usable frequency condition were usually some ten or twenty degress to the east of the true direction, which was afterwards gradually approached." Calculations of bearing deviation based on changes with time of the equivalent height of reflection agreed with the directional observations.

621.396.93 **2126**

Radio Direction Finding.—(*Electrician*, 1st Nov.

1946, Vol. 137, No. 3570, pp. 1213–1215.) Summaries of the following papers read before the I.E.E. Radio Section : The Use of Earth Mats to reduce the Polarization Error of U-Type Adcock Direction-Finders, by R. L. Smith-Rose & W. Ross. The Development and Study of a Practical Spaced-Loop Radio Direction-Finder for H.F., by W. Ross. Site and Path Errors, by W. Ross. Experiments on Conducting Screens for a U-Type Spaced-Aerial Radio Direction-Finder in the Frequency Range 600–1 200 Mc/s, by R. R. Pearce. The Location of Thunderstorms by Radio Direction-Finding, by F. Adcock & C. Clarke.

621.396.93 : 621.396.663 **2127**

The Design of Electromagnetic Radiogoniometers for Use in Medium-Frequency Direction-Finding.—J. H. Moon. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 69–77.) An investigation into the causes of errors and an account of modifications designed to reduce them. The more important results obtained with a new and improved design are tabulated ; this design is shown to be 6 db better in signal/noise ratio than any existing design and has a maximum instrumental error of less than ±½°.

621.396.933 + 621.396.96 **2128**

Radar Navigation.—(*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 2, pp. 511–512.) A discussion led by H. B. Law on 1789/1791 and 1793 of June (Dippy ; Jones ; Wood ; Carter).

621.396.933 **2129**

A Review of Radio Aids in Aviation.—C. B. Bovill. (*J. Brit. Instn Radio Engrs*, Dec. 1946, Vol. 6, No. 6, pp. 250–272.) An introduction to the applications of the radio art to aeronautics, with a discussion of some of the technical and practical problems involved.

621.396.96 **2130**

The Maximum Range of a Radar Set.—K. A. Norton & A. C. Omberg. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, pp. 4–24.) Formulae are developed for calculating the maximum range. The parameters considered are atmospheric attenuation, transmitted power, aerial gains, transmission-line losses, noise factor of the receiver, visibility of the pulse depending on the pulse width, receiver bandwidth, pulse recurrence frequency and type of display, externally generated noise including fluctuation noise from space or the sun, and position of the aerials with respect to the ground as it affects the polar diagrams and the effective echoing area of the target. The effective area of spherical reflectors is considered in detail in terms of Fresnel zones and the derived formulae are applied to calculate the intensity of radio reflections from the moon. A table gives values of the various parameters for twenty different radar equipments together with the derived range indices. An appendix gives formulae for the characteristics of elliptical ground-reflection Fresnel zones on a plane earth.

621.396.96 : 535.39 **2131**

Frequency Dependence of the Properties of Sea Echo.—Goldstein. (*See* 2218.)

621.396.96 : 621.396.664] : 621.392.029.64 **2132**

High-Speed Waveguide Switch.—Bishop. (*See* 2253.)

621.396.96(71) **2133**

Radar Development in Canada.—F. H. Sanders. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 195–200.) A brief survey of the visit of the Canadian group to England in 1939, of the visit of the Tizard Mission to N. America in 1940, and the subsequent development and production of radar in Canada.

621.396.96 **2134**

Radar—What It Is. [Book Review]—J. F. Rider & G. C. B. Rowe. J. F. Rider, New York, 1946, 80 pp., $1.00. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, p. 190.) For the average non-technical reader.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **2135**

Decay of Zinc Sulphide Type Phosphors.—H. A. Klasens & M. E. Wise. (*Nature. Lond.*, 5th Oct. 1946, Vol. 158, No. 4014, pp. 483–484.) A calculation of luminescence intensities over the whole decay period. See also 1808 of 1946.

535.37 **2136**

On the Mechanism of the Luminescence of Phosphors.—V. V. Antonov-Romanovski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1945, Vol. 9, Nos. 4/5, pp. 369–390. In Russian.) A critical survey of the present state of knowledge, including some of the author's results.

538.114 : 669.15.24 **2137**

Magnetoresistance and Domain Theory of Iron-Nickel Alloys.—R. M. Bozorth. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 923–932.) Domain theory is applied to iron-nickel alloys to predict the ratio of tension to magnetic field at which the resistivity is equal to that of a normal unmagnetized alloy. The theory is accurately confirmed by measurements. The difference between the resistances measured in (*a*) a transverse, and (*b*) a longitudinal magnetic field is independent of the domain distribution in the normal state.

538.221 **2138**

Ferromagnetic Properties of the Compounds $MnNi_3$ and Fe_3C.—C. Guillaud. (*C. R. Acad. Sci., Paris*, 13th Dec. 1944, Vol. 219, No. 23, pp. 614–616.)

538.3 : 539.215.2 **2139**

The Electrical Constants of a Material Loaded with Spherical Particles.—L. Lewin. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 65–68.) A theoretical investigation of the permittivity and permeability of a mixture consisting of a homogeneous material in which particles are embedded. Air bubbles as 'particles' in dielectrics and iron-dust cores are considered.

The permeability may depart from unity or be complex even when none of the substances is ferromagnetic.

546.287 + 679.5 **2140**

Plastics and Silicones.—(*Gen. elect. Rev.*, Jan. 1947, Vol. 50, No. 1, pp. 47–48.) A list of new developments.

549.514.1 : 537.228.1 **2141**

A Theory of the Control of Twinning in Quartz.—W. A. Wooster. (*Nature, Lond.*, 18th Jan. 1947, Vol. 159, No. 4029, pp. 94–95.) The theory accounts for the production of substantially single-crystalline specimens by the application of a torque at temperatures somewhat lower than the α-β transition point. See also 1874 of 1946.

620.2 : 621.396.69(213) **2142**
Choice of Materials for Tropical Radio Equipment.—D. F. Livingstone & J. W. Whitehead. (*J. Brit. Instn Radio Engrs*, Sept./Nov. 1946, Vol. 6, No. 5, pp. 172–176.) A brief guide intended to assist in the examination of materials and radio equipment to decide whether or not they are suitable for tropical use. No details of tropicalization methods or specific tropical components are included.

621.314.63 : 621.315.59 **2143**
The Thermal Energy of Rectification.—H. I. Amirhanov. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 447–456. In Russian with English summary.) A semiconductor placed between two electrodes becomes a rectifier if the electrodes are kept at different temperatures. Experiments with Cu_2O and PbS are described and the results tabulated and curves plotted. The direction of rectification depends on whether the conductivity of the sample is of the electron or hole type. The distribution of resistivity in the barrier layer was also investigated. A theoretical interpretation of the results is given.

621.315.6 : 621.396 **2144**
New Dielectric and Insulating Materials in Radio Engineering.—(*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 58–59.) Summary of I.E.E. Radio Section discussion led by J. C. Swallow and G. P. Britton.

621.315.616.018.14 **2145**
A Note on the Effect of Combined Carbon Monoxide on the Power Factor of Polythene.—W. Jackson & J. S. A. Forsyth. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 55–57.) Slight concentrations of carbon monoxide in the original ethylene gas are sufficient to cause an appreciable increase in the power factor of the polymer. Power factors of pure and impure polythene are shown graphically. For previous work see 2768 of 1945.

621.315.616.9.015.5 **2146**
Intrinsic Electric Strength of Polythene.—W. G. Oakes. (*Nature, Lond.*, 4th Jan. 1947, Vol. 159, No. 4027, pp. 29–30.) Measurements of the d.c. electric strength support the predictions of Fröhlich's theory.

621.318.23 **2147**
The Design and Application of Modern Permanent Magnets.—A. J. Tyrrell. (*J. Brit. Instn Radio Engrs*, Sept./Nov. 1946, Vol. 6, No. 5, pp. 178–213.) A short account is given of the development of permanent magnetic alloys, with a table of the properties of many commercial magnet materials. Methods of measurement of the magnetic properties and performance are discussed. Manufacturing problems, heat treatment, stabilization and methods of magnetization are fully treated. The general principles of design are considered and detailed design procedure is given for the types of permanent magnets required in loudspeakers, meters, motors, generators, etc. The design of magnetron magnets requires special treatment and is only mentioned briefly. Applications are considered with particular reference to the use of Ticonal-G alloy, for which magnetic characteristic graphs are given.

621.318.23 **2148**
Discussion on the Design and Application of Modern Permanent Magnets.—G. L. Hamburger. (*J. Brit. Instn Radio Engrs*, Dec. 1946, Vol. 6, No. 6, pp. 247–248.) A discussion with special reference to Tyrrell's paper (2147 above).

621.318.323.2.042.14 : 621.317.331 **2149**
Measurement and Control of Interlaminar Resistance of Laminated Magnetic Cores.—Franklin. (*See* 2170.)

621.357.6 **2150**
Electroforming for Precision.—H. R. Clauser. (*Sci. Amer.*, Jan. 1947, Vol. 176, No. 1, pp. 15–17.) The outstanding characteristics of electroforming are the extremely high surface smoothness attainable, the very close dimensional tolerances possible and the ability to produce intricate shapes accurately.

621.357.9 **2151**
Electrolytic Polishing and Superfinishing.—R. Mondon. (*Tech. mod.*, 1st/15th Dec. 1946, Vol. 38, Nos. 23/24, pp. 281–286.) Dissolving the successive surface layers makes it possible to examine their properties. Electrolytic polishing may be of considerable value in studying fatigue in metals.

621.791.353 : 669.018.21 **2152**
Metallic Joining of Light Alloys : Parts 1 & 2.—(*Light Metals*, Jan. & Feb. 1947, Vol. 10, Nos. 108 & 109, pp. 20–32 & 103–108.) General discussion of methods of joining thin light-weight alloys and of the metallurgical aspects of soft soldering. Details are given of the many different soft solders which have been suggested for aluminium. The lack of coordinated investigation and of field test results is stressed. To be continued.

621.798 : 621.396.694 **2153**
General Principles of Valve-Crate Design.—R. A. L. Cole. (*Elect. Commun.*, Sept. 1946, Vol. 23, No. 3, pp. 320–326.)

669.018.58 : 621.318.22 **2154**
Formable Magnets.—(*Sci. Amer.*, Jan. 1947, Vol. 176, No. 1, p. 36.) Two new magnetic alloys, Cunico and Cunife, are soft enough to be machined and can be punched or even drawn into wire, thus allowing magnets to be made of any size or shape.

669.3.019.2 **2155**
Micrographic Study of Copper. Detection of Inclusions, Hardening, Recrystallization and Microcracks.—P. A. Jacquet. (*Tech. mod.*, 1st/15th Nov. 1946, Vol. 38, Nos. 21/22, p. 280.) Summary of a paper published in *Bull. Soc. franç. Métall.*, 1945 (first half of year). See also 648 of 1946 (Jacquet).

669.721.891 + 669.721.5.891 **2156**
Rates of High-Temperature Oxidation of Magnesium and Magnesium Alloys.—T. E. Leontis & F. N. Rhines. (*Metals Technol.*, June 1946, Vol. 13, No. 4, Tech. Publ. No. 2003, 28 pp. Discussion, Jan. 1947, Vol. 14, No. 1, Tech. Publ. No. 2039, pp. 7–9.) The linear oxidation was measured in the temperature range 412 – 575° C. The rate was found to vary exponentially with the absolute

temperature. Alloying increases the rate if the melting point is appreciably lowered. A protective oxide film is formed at low temperatures, a non-protective loose scale at higher temperatures. These results are explained theoretically.

669.738 : 620.193.23 **2157**

Comparison of Electro-Plated Finishes under Humidity Tests.—E. E. Halls : F. Taylor. (*Metallurgia, Manchr*, Jan. 1947, Vol. 35, No. 207, pp. 137–139.) Comment on 1485 of May and Taylor's reply. A table is given of the comparative behaviour of relatively thin electroplate coatings, with and without passivation, on soft iron, when subjected to cycles of the W. T. Board K 110 test. *Note.* U.D.C. of 1485 should read 620.193.23.

678.1.001.5 (773) **2158**

Rubber Laboratory.—(*Sci. Amer.*, Jan. 1947, Vol. 176, No. 1, p. 33.) A short account of research activities at the University of Illinois.

678.7 : 539.31 : 534.213 **2159**

Acoustic Determination of the Physical Constants of Rubber-Like Materials.—A. W. Nolle. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 194–201.)

679.5 **2160**

Taking the Stress out of Styrene.—C. A. Breskin. (*Sci. Amer.*, Jan. 1947, Vol. 176, No. 1, pp. 11–14.) Details of annealing processes for removing thermally or mechanically induced strains from moulded parts.

679.5 : 621.3 **2161**

The Growing Importance of Plastics in the Electrical Industry.—G. Haefely. (*Beama J.*, Jan. 1947, Vol. 54, No. 115, pp. 14–19 ; *Electrician*, 20th Dec. 1946, Vol. 137, No. 3577, pp. 1760–1762.) Summaries of a paper presented before the I.E.E Installations Section. For another account see 1122 of April.

679.5 : 621.365.92 **2162**

Pre-Heating by High-Frequency Currents.—Maddock. (*See* 2196.)

678.1 : 62 **2163**

Rubber in Engineering. [Book Notice]—H.M. Stationery Office, London, 10*s.* (*Govt. Publ., Lond.*, Nov. 1946, p. 14.) Joint publication of the Ministry of Supply, the Admiralty and the Ministry of Aircraft Production.

MATHEMATICS

518.5 **2164**

Machines Speed Science.—(*Sci. News Lett., Wash.*, 25th Jan. 1947, Vol. 51, No. 4, pp. 51–52.) Discusses the operational principles of the Harvard Mark II automatic sequence control calculator, built for use at the Naval Proving Grounds, Dahlgren, Va, to solve problems of guided missile flight and of bomb and shell trajectories.

518.5 : 621.317.733 **2165**

Bridge Type Electrical Computers.—W. K. Ergen. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 138.) Based on the Wheatstone bridge, with the resistances of three arms proportional to different quantities. Developments include a bridge used for the solution of the quartic equation of a line in bipolar coordinates. Summary of Amer. Phys. Soc. paper.

517.564.4(083.5) **2166**

British Association for the Advancement of Science. Mathematical Tables. Part-Volume A : Legendre Polynomials. [Book Review]—Committee for the Calculation of Mathematical Tables. Cambridge University Press, 1946, A42 pp., 8*s.* 6*d.* (*Nature, Lond.*, 11th Jan. 1947, Vol. 159, No. 4028, p. 46.) $P_n(x)$ is tabulated for integers n from 2 to 12, and for the range $x = 0$ to 6 at intervals of 0.01.

518.61 **2167**

The Escalator Method in Engineering Vibration Problems. [Book Review]—J. Morris. Chapman & Hall, London, 270 pp., 21*s.* (*J. sci. Instrum.*, May 1947, Vol. 24, No. 5, p. 140.) The solution by this method of simultaneous linear equations and Lagrangian frequency equations is fully investigated, with special reference to stiffness and vibration problems. This is the comprehensive account referred to in 463 of February.

MEASUREMENTS AND TEST GEAR

621.3.087 : 621.38 **2168**

Electronic Recording Instruments.—(*See* 2248.)

621.317.323.027.7 : 537.533.73 **2169**

Diffraction of Non-Monokinetic Electrons ; Application to the Measurement of High Alternating Voltages.—J. J. Trillat. (*C. R. Acad. Sci., Paris*, 12th Aug. 1946, Vol. 223, No. 7, pp. 322–324.) With a non-monokinetic beam of electrons and a sinusoidal accelerating voltage, the usual spots given by a thin sheet of mica are replaced by 'comets' with bright heads near the centre of the diffraction pattern and tails thinning out radially, finally vanishing completely. Knowing, from X-ray measurements, the constants of the mica sheet, the radial length of the tail of a comet of known order terminating nearest the centre of the diffraction pattern can be used to determine the peak value of the accelerating voltage, from about 10 to 100 kV.

621.317.331 : 621.318.323.2.042.14 **2170**

Measurement and Control of Interlaminar Resistance of Laminated Magnetic Cores.—R. F. Franklin. (*ASTM Bull.*, Jan. 1947, No. 144, pp. 57–61.) An instrument is described for testing, under simulated operating conditions, films applied to sheet steel. A number of individual multiple contacts to which voltage is applied are pressed against the insulating surface under predetermined conditions of voltage, pressure and temperature and the total current through the contacts is measured. The results obtained have been found more useful than those given by the present A.S.T.M. test ; the new test has proved of great value in the study of insulating films and their application to steel sheets and punchings.

621.317.336.029.63 **2171**

Impedance Measurements with a Non-Tuned Lecher System.—J. M. van Hofweegen. (*Philips tech. Rev.*, Sept. 1946, Vol. 8, No. 9, pp. 278–286.) From voltage measurements along the Lecher wires when loaded by the impedance to be measured, the reflection factor is determined. The impedance can then be calculated : a graphical method is described. Details are given of apparatus suitable for use with decimetre waves.

621.317.382.08 : 621.392.3 **2172**

A Coaxial-Type Water Load and Associated Power-Measuring Apparatus.—R. C. Shaw & J. R. Kircher. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, pp. 84–87.) Describes its design, construction and use with a thermistor bridge for measuring peak pulse powers of a megawatt at λ 10–40 cm with an accuracy of 5–10%.

621.317.4 **2173**

A.C. Measurements of Magnetic Properties.—H. W. Lamson. (*Communications*, Jan. 1947, Vol. 27, No. 1, p. 19.) An iron-cored inductor should be represented by a reactance ωL carrying the magnetizing current and in parallel with a core-loss resistance R carrying the loss current, the combination being in series with a copper-loss resistance R_c carrying the full exciting current. A method is described for the study of magnetic cores, whereby all necessary data can be obtained, including the hysteresis angle, which is the phase lag of the magnetizing current with reference to the exciting current. Summary of a Rochester Fall Meeting paper.

621.317.651.029.3 **2174**

Tachometric Audio-Frequency Meter.—E. Kasner. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 121–123.) "Eccles-Jordan scale-of-two trigger circuits divide the audio input frequency and produce two-phase output for driving a synchronous motor and magnetic drag tachometer. Frequencies from 30 to 450 cycles are indicated directly by a pointer, with 0.5% accuracy."

621.317.715.5 **2175**

Equipment and Appliances : High-Sensitivity Mirror Galvanometer.—(*Electrician*, 1st Nov. 1946, Vol. 137, No. 3570, p. 1202.) A low-resistance instrument with a period of 15–20 sec and negligible zero creep, particularly suitable for permeability and magnetic measurements. With an 850-Ω coil, the sensitivity at 1 m scale distance is 16 000 mm/μA or 100 mm/μV.

621.317.726 **2176**

An Automatic-Slideback Peak Voltmeter for measuring Pulses.—C. J. Creveling & L. Mautner. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 208–211.) Automatic slideback is provided by the amplified and rectified output from a diode in series with the pulse source. The error is less than ± 6% for repetition frequencies of 50–5 000 c/s and pulse durations of $\frac{1}{2}$–15 μs. An improved version has an error of less than ± 2% over the range 25–10 000 c/s.

621.317.738 **2177**

Finding the Inductance of R.F. Coils.—R. M. Crotinger. (*QST*, March 1947, Vol. 31, No. 3, pp. 54–56.) The circuit and details of a mains-operated electron-coupled oscillator having a frequency range of 2–16 Mc/s. A grid current meter is used as an indicator.

621.317.76 **2178**

An Instrument for Short-Period Frequency Comparisons of Great Accuracy.—H. B. Law. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 38–41.) Phases of the two 100-kc/s inputs are compared in a phase discriminator, the output of which controls a trigger circuit. Trigger pulses operate an accurate chronometer which thus measures the time period between consecutive beats. Comparison of frequencies differing by 1 part in 10^6 can be made to an accuracy of 1 part in 10^{11} over the period of a single beat.

621.317.761 **2179**

A Frequency Meter for the 100-kc/s to 50-Mc/s Range.—A. J. Zink, Jr. (*Communications*, Jan. 1947, Vol. 27, No. 1, pp. 10, 11..37.) Containing an internal calibrating oscillator using a 100-kc/s crystal, a calibrated oscillator with tuning range from 1–2 Mc/s in five 200-kc/s stages, and flexible coupling for external signals.

621.317.761 : 621.396.621 **2180**

A 100-kc/s Frequency Standard for Receivers.—J. N. Whitaker. (*Communications*, Feb. 1947, Vol. 27, No. 2, pp. 24..39.) A small unit, with 100-kc/s crystal oscillator in aperiodic circuit, adjustable to zero beat of harmonics with Bureau of Standards transmissions. Marker signals are obtained at 100-kc/s intervals throughout the receiver tuning range.

621.317.79 : 621.396.611 **2181**

The Design of a Universal Automatic Circuit Tester, and Its Application to Mass-Production Testing.—R. C. G. Williams, J. E. Marshall, H. G. T. Bissmire & J. W. Crawley. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 20–26.) A differential valve amplifier circuit compares impedances in the unit under test with standard impedances, a.c. and d.c. being used successively. Connexion into the unit is made through the valve-holders. Operation is automatic and small transmitter-receivers have been tested at a rate of 20 per hour.

621.392.4.08 : 621.397.5 : 621.396.67 **2182**

Application of Transmission Line Measurements to Television Antenna Design : Parts 1 & 2.—Hamilton & Olsen. (*See* 2262.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

518.5 : 621.317.733 **2183**

Bridge Type Electrical Computers.—Ergen. (*See* 2165.)

534.321.9 : 620.179.1 **2184**

Supersonic Applications.—M. E. Hutter. (*Elect. Times*, 6th Feb. 1947, Vol. 111, No. 2885, pp. 162–165.) Use of supersonic waves for flaw detection and marine depth sounding.

536.48 **2185**

On the Possible Use of Brownian Motion for Low Temperature Thermometry.—J. B. Brown & D. K. C. MacDonald : A. W. Lawson & E. A. Long. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 976–978.) Criticism of 483 of February, and the authors' reply.

537.533.7 **2186**

Interruption of Electron Beams.—Selme. (*See* 2020.)

537.533.8 **2187**

Simple Means of observing Electron Images.—S. Goldsztaub. (*C. R. Acad. Sci., Paris,* 6th Nov. 1944, Vol. 219, No. 18, pp. 445–446.) The X rays emitted when electrons strike a very thin anticathode are observed either by coating it with fluorescent material or by applying photographic paper. A resolving power of the order of 0.1 mm is obtainable. Considerably larger images can be obtained by using Lenard window technique.

621.3 : 629.1.001.4 **2188**

Little Shakers test Big Structures.—J. Markus. (*Sci. Amer.,* Jan. 1947, Vol. 176, No. 1, pp. 6–10.) For another account see 1147 of April.

621.3.013.2 : 544 **2189**

Amplified Radio Frequencies identify Chemical Elements.—(*Sci. News Lett., Wash.,* 1st Feb. 1947, Vol. 51, No. 5, p. 71.) A new method developed by F. Bloch, W. W. Hansen and M. Packard at Stanford University. Substances are rotated in a powerful magnetic field and the atomic resonance frequencies are used for identification.

621.318.572 : 531.76 **2190**

An Electronic Decimal Counter Chronometer.—S. S. West. (*Electronic Engng,* Jan. & Feb. 1947, Vol. 19, Nos. 227 & 228, pp. 3–6 & 58–61.) The counter uses a set of scale-of-ten units which enable time intervals to be read directly to five significant figures on a row of meters scaled from 0 to 9. Each unit comprises a scale-of-two and a scale-of-five circuit, whose operation is described in some detail, with a circuit diagram but no component values. The pulse-shaping circuit used to convert an arbitrary input signal to the waveform required by the counter consists essentially of a two-valve trigger circuit giving an output of discontinuous steps even when the input waveform is continuous. Two such trigger pairs are used in the switching circuit which introduces and cuts out a crystal-controlled 100-kc/s oscillator at the start and finish of the time interval to be measured. The number of cycles counted in the interval is shown by the positions taken up by the meter pointers, which remain stationary until the reset push button is pressed. The valves used are EF50 h.f. pentodes. Considerable numbers of these chronometers have been manufactured and they have found many applications in the accurate measurement of short time intervals. A modified version provides a time-interval generator of high accuracy.

621.318.572 : 539.17 **2191**

Electronic " Stopwatch " times Atomic Particles.—(*Sci. News Lett., Wash.,* 25th Jan. 1947, Vol. 51, No. 4, p. 61.) Operation depends upon the synchronization of electrical counters which serve as pulse detectors. Timing to 10^{-9} sec is accomplished by measuring the delay inserted in order to synchronize the counters.

621.318.572 : 621.396.645 **2192**

Photo-Counters and Poisson's Law.—Blanc-Lapierre. (*See* 2047.)

621.365 : 621.396.615.141.2 **2193**

High-Frequency Heating.—(*Gen. elect. Rev.,* Jan. 1947, Vol. 50, No. 1, pp. 25–26.) Development of magnetron equipment for industrial applications.

621.365.92 **2194**

The High-Frequency Heating of Nonconducting Materials.—F. J. Jolly. (*Trans. Amer. Soc. mech. Engrs,* Feb. 1947, Vol. 69, No. 2, pp. 155–162.) An explanation of the theoretical basis and practical limitations of high-frequency dielectric heating and brief descriptions of its applications in various industries.

621.365.92 : 62 **2195**

High-Frequency Induction Heating.—E. May. (*Engineer, Lond.,* 14th Feb. 1947, Vol. 183, No. 4753, pp. 178–180.) Survey of industrial applications: melting, surface hardening, brazing, soldering, etc. About 500 kWh is needed per ton of metal melted; equipment cost is about £100 per kW output; running cost about £1 per 100 kWh.

621.365.92 : 679.5 **2196**

Pre-Heating by High-Frequency Currents.—A. J. Maddock. (*Elect. Commun.,* Sept. 1946, Vol. 23, No. 3, pp. 291–296.) The advantages to be gained by the pre-heating of plastic preforms are discussed in relation to h.f. heating. The effect of the physical properties of the material on equipment design is considered. The variation of heating time with specimen thickness is shown graphically for various types of phenolic thermosetting materials.

621.38.001.8 : 62 **2197**

Electronics in the Caterpillar Tractor Plant.—A. A. McK. (*Electronics,* Feb. 1947, Vol. 20, No. 2, pp. 104–109.) A general description of nearly 50 different applications of electronics, used with the object of improving safety of personnel, or quality or speed of production.

621.38.001.8 : 621.313.2 **2198**

Electronic D.C. Motor.—(*Gen. elect. Rev.,* Jan. 1947, Vol. 50, No. 1, p. 28.) A power supply using sealed ignitrons gives zero to full-speed regulation by armature-voltage control, or zero to base-speed regulation by armature-voltage control, with field control above base speed, for drives from 75 to 600 h.p.

621.383.49 : 621.395.625.6 **2199**

The Use of Sulphur-Thallium Photocells in Sound Pictures.—B. T. Kolomiec. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1941, Vol. 5, Nos. 4/5, pp. 506–509. In Russian with English summary.) Sulphur-thallium photocells can be used for the reproduction of sound. When they were tested in three Leningrad cinemas, it was found that: (*a*) amplifier photocascades were unnecessary, (*b*) the sound-reproduction apparatus was simplified and the rectifier requirements became less stringent, (*c*) the photocells produced no noise, (*d*) the low input resistance removed the influence of electrostatic induction on the amplifier output stage. Sound reproduction was thus improved.

621.384.6 : [621.392.029.64 + 621.396.611 **2200**

Cavities and Waveguides associated with Charged Particle Accelerators.—T. Kahan. (*C. R. Acad. Sci., Paris,* 24th Feb. 1947, Vol. 224, No. 8, pp. 548–549.)

621.385.833 **2201**

" Shadow-Cast " Replicas for Use in the Electron Microscope.—H. Thielsch. (*Metals Technol.,* Feb. 1946, Vol. 13, No. 2, Tech. Publ. No. 1977, 10 pp.

Discussion, Jan. 1947, Vol. 14, No. 1, Tech. Publ. No. 2039, pp. 1-2.) Transparent replicas of collodion or formvar are coated with a thin metallic film by vacuum evaporation. Manganese has been found to give excellent results. For most evaporations the angle between the replica surface and the line from filament to replica should be about 40–50°. Numerous photographs show the results obtained.

621.385.833 **2202**

On the Disturbing Potential due to Ellipticity of Electrostatic Lenses.—F. Bertein. (*C. R. Acad. Sci., Paris*, 24th Feb. 1947, Vol. 224, No. 8, pp. 560-562.) A method is given for calculating the corrective potential appropriate to the ellipticity defect of the system. See 1521 of May.

621.386.1 **2203**

X-Ray Tube with Great Intensity and Point Focus.—S. Goldsztaub. (*C. R. Acad. Sci., Paris*, 17th Feb. 1947, Vol. 224, No. 7, pp. 458–459.) The electron beam is focused by means of electronic lenses and a spot of diameter only 0.2 mm is obtained. With a beam current of 1 mA at 30 kV, the brightness is of the order of 475 W/mm^2.

621.386.1 : 539.4 **2204**

X-Ray Method of Measuring Poisson's Ratio.—R. F. Hanstock & E. H. Lloyd. (*Engineering, Lond.*, 17th Jan. 1947, Vol. 163, No. 4227, pp. 68–70.) An electron diffraction method. Some results obtained for hiduminium RR56 alloy are given.

621.386.1.032.2 **2205**

X-Ray Tube with Movable Anticathode.—A. J. Rose. (*C. R. Acad. Sci., Paris*, 17th Feb. 1947, Vol. 224, No. 7, p. 460.) Uses a flexible metallic tube to permit displacement of the anticathode. Short exposures with high-energy beams are thus obtained.

621.386.84 : 620.179.1 **2206**

20 Million-Volt X-Ray Machine penetrates Heavy Steel Sections.—(*Materials & Methods*, Jan. 1947, Vol. 25, No. 1, p. 138.) A betatron specially designed for industrial radiography and capable of detecting flaws from $\frac{1}{32}$ inch to $\frac{1}{10}$ inch in diameter in forgings, welds, etc., up to 2 ft thick.

621.389 : 535.61-15 **2207**

Infra-Red Equipment for "Night" Vision.—(*Engineer, Lond.*, 14th Feb. 1947, Vol. 183, No. 4753, p. 170.) Brief reference to wartime applications by British Services: midget submarine attacks on the 'Tirpitz', the sinking of the Bergen floating dock, identification of friendly aircraft, etc. The complete signalling equipment weighs $1\frac{1}{4}$ lb; the equivalent German 'Seehund' weighs 16 lb.

621.39.001.8 : 61 **2208**

Electromedical Equipment. Berman Locator.—(*Gen. elect. Rev.*, Jan. 1947, Vol. 50, No. 1, p. 37.) Audible signals rise in pitch as the probe approaches a metallic foreign body.

PROPAGATION OF WAVES

551.510.535 + 523.746 + 621.396.812 **2209**

Ionosphere Review.—Bennington. (*See* 2117.)

551.594.6 : 523.746.5 **2210**

Ionospheric Fluctuations of Sudden Origin and the Eleven-Year Solar Cycle.—Bureau. (*See* 2122.)

621.396.11.029.64 : 517.942 **2211**

Asymptotic Solutions for the Normal Modes in the Theory of Microwave Propagation.—C. L. Pekeris. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1108–1124.) Several extensions of the 'W.K.B.' method for the asymptotic solution of differential equations are considered, with particular reference to the normal-mode theory of microwave propagation. An outline is given of this theory for propagation in an atmosphere with a horizontally stratified refractive index, the case of a surface duct being emphasized. In a study of 'leaky modes' the "aim has been to obtain explicitly the terms after the leading one in the asymptotic expansion of the solution, in order to have an estimate of the order of magnitude of the error introduced by the use of the leading term only".

Equations are given for the first correction terms to the phase-integral solution for the characteristic values of the normal modes. An alternative asymptotic solution for the case of leaky modes, which includes first correction terms, is also given. See also 507 of February.

621.396.619.029.6 **2212**

Propagation of Amplitude- and Frequency-Modulated Short-Wave Oscillations.—Hölzler, Gecks & Kamphausen. (*See* 2236.)

621.396.81.029.6 **2213**

Very-High-Frequency and Ultra-High-Frequency Signal Ranges as Limited by Noise and Co-Channel Interference.—E. W. Allen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 128–136, Discussion, pp. 136–152.) "Theoretical ground-wave ranges for smooth-earth and standard-atmosphere conditions are shown for frequency-modulation and television broadcast services and for mobile services for frequencies between 30 and 3 000 megacycles, and practical limits of antenna size and antenna gain are discussed. The effects of external noise, terrain, and penetration of buildings are considered and their probable trends with frequency are indicated, together with the need for comprehensive data for their evaluation.

"A comparison is made between theoretical ground-wave and tropospheric ranges computed for 50 megacycles and the results of continuous field-intensity measurements made at various distances, from which it is concluded that theoretical ground-wave curves can be used as reliable measures of service ranges. Theoretical ground-wave curves are found not to be direct measures of probable ranges of tropospheric interference and it is suggested that a factor of 2 be applied to the station-separation distances obtained from such curves at 50 megacycles, with the probability of larger factors for higher frequencies.

"Two families of curves, one for sporadic-E-layer and one for F-layer transmission, showing skip distances as a function of frequency for the frequency band under consideration, are derived from the National Bureau of Standards measurements of layer characteristics at Washington, D.C., for the purpose of estimating the occurrence of interference from one other co-channel station. The effect of increasing the number of stations is investigated, and estimates of five times the single-station interference for sporadic-E-layer and three times for F-layer interference are made.

"Combining the above factors, an estimate is made of comparative service areas at 46 and 105 megacycles for frequency-modulation broadcast stations of 1 kilowatt and 340 kilowatts effective power, and the reduction in area due to the effects of external noise, hills, and station interference by bursts and sporadic-E- and F-layer propagation."

In the discussion C. M. Jansky points out the importance of the paper in that it records the evidence on which the Federal Communications Commission decided to assign to f.m. broadcasting frequencies of about 100 Mc/s instead of 50 Mc/s. He quotes Dellinger who considers that ionospheric interference on both frequency bands is very small.

Armstrong considers that calculations of fields based on propagation in a standard atmosphere are inadequate as fading is not considered. He points out that interference due to sporadic-E is greater than that predicted by the author.

Carnahan and Brown also stress the serious effects of fading at points beyond the horizon.

de Mars gives graphs of theoretical signal variation with distance for different transmitting aerial heights assuming a standard atmosphere, and also of observed signal variations, and shows that the author's estimates are "not in accord with observations and measurements in any portion of the frequency band under consideration".

The author's reply is given.

621.396.81.029.62 **2214**

Field Intensities beyond Line of Sight at 45.5 and 91 Megacycles.—C. W. Carnahan, N. W. Aram & E. F. Classen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 152–159.) The effects of tropospheric propagation conditions on the median value of the field strength and on fading are compared for the two frequencies over a path of 76 miles.

2215

621.396.812 : 523.78 "1945.07.09" : 551.510.535

Various Papers on the Solar Eclipse of 9th July 1945 and Its Effects on Propagation and the Ionosphere.—(*See* 2092 to 2096.)

621.396.824 **2216**

Lateral Deviation of Radio Waves at Sunrise.—Ross & Bramley. (*See* 2125.)

621.396.945 **2217**

Radio-Geological Conditions for Radio Communication in Mines.—V. Fritsch. (*Radio Welt*, Nov. & Dec. 1946, Vol. 1, Nos. 3 & 4, pp. 39–43 & 59–64.) A discussion of the effects of different types of strata, the occurrence of faults, etc., on underground radio field strengths.

621.396.96.029.64 : 535.39 **2218**

Frequency Dependence of the Properties of Sea Echo.—H. Goldstein. (*Phys. Rev.*, 1st/15th Dec. 1946, Vol. 70, Nos. 11/12, pp. 938–946.) Measurements were made at 9.2, 3.2, and 1.25 cm at grazing incidence over a wide range of sea states. The wavelength dependence of a quantity termed the 'sea echo cross section per unit area of the sea surface' was found to lie between λ^0 and λ^{-4}, and a modified drop theory is proposed which assumes the presence of drops whose diameter is of the order of λ.

RECEPTION

551.594.6 : 621.39.029 **2219**

Effect of Wavelength on the General Level of Atmospherics.—Bureau. (*See* 2123.)

621.396.619.13/.14 **2220**

N.F.M. Reception.—G. G. (*QST*, March 1947, Vol. 31, No. 3, pp. 30–32.) A discussion on narrow-band f.m. reception in the amateur bands, pointing out some of the advantages of phase modulation.

621.396.619.13 **2221**

Some Investigations on Oscillations with Frequency Modulation. [Thesis]—F. L. H. M. Stumpers. N. V. Philips' Gloeilampenfabrieken Research Laboratory, Eindhoven. Reprints are available. (*Philips tech. Rev.*, Sept. 1946, Vol. 8, No. 9, pp. 287–288.) The frequency spectrum occurring with different kinds of modulation is calculated. Interference, noise and disturbances are investigated. Distortion is calculated by Fourier analysis and the series of Carson and Fry, and by the author's alternative method. Results are compared with experiment. "A new method for determining the distortion of the measuring emitter directly from the spectrum deserves attention." Brief summary only.

621.396.62.029.6 **2222**

Design of Communication Receivers for the Naval Service with Particular Consideration to the Very-High-Frequency and Ultra-High-Frequency Ranges.—T. McL. Davis & E. Toth. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 201-207.) Owing to the close proximity of many transmitting and receiving aerials on a ship, mutual interference is probable. Methods of avoiding this by suitable design of the h.f. and i.f. stages are discussed.

621.396.621.029.62 **2223**

An Improved Receiver for Two Meters.—C. F. Hadlock. (*QST*, March 1947, Vol. 31, No. 3, pp. 35–40.) Details and circuit diagram of a superheterodyne receiver having an i.f. of 10.7 Mc/s and a superregenerative second detector.

621.396/.397].621.004.67 **2224**

The Servicing of Radio and Television Receivers.—R. C. G. Williams. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 11–19.) A comprehensive survey of the responsibilities, personnel and equipment problems of the service organization and the inter-relationship between service and design. All relevant statistics are shown graphically. See also 222 of January.

621.396.621(492)" 1943/1945 " **2225**

Secret Production of Radio Receivers in Occupied Territory.—"One out of many". (*Philips tech. Rev.*, Nov. 1946, Vol. 8, No. 11, pp. 337–340.) An account, with photographs, of many ingenious methods of construction used in Holland.

621.396.645 : 621.38 **2226**

Shot Effect and Fluctuations at the Output of a Linear Amplifier.—Blanc-Lapierre. (*See* 2048.)

621.396.822 : 621.317.7.089.6 **2227**

Factors affecting the Accuracy of Radio Noise Meters.—H. E. Dinger & H. G. Paine. (*Proc.

Inst. Radio Engrs, W. & E., Jan. 1947, Vol. 35, No. 1, pp. 75–81.) Experimental work is needed to make an increase in the absolute accuracy of noise measurements possible, though some of the more serious errors can be avoided by proper design, construction, calibration and operation.

621.396.822 : 621.396.621 **2228**

Input Circuit Noise Calculations for F.M. and Television Receivers.—W. J. Stolze. (*Communications*, Feb. 1947, Vol. 27, No. 2, pp. 12, 13..51.) Discusses the three factors—total noise, sensitivity and signal/noise ratio—that must be taken into consideration in efficient design of the input stages of such receivers and presents formulae for calculating thermal agitation noise, shot noise and induced grid noise. Total noise calculations are made for the grid of a f.m. receiver r.f. amplifier stage.

621.396.822 : 621.396.621.029.64 **2229**

A Note on Noise and Conversion-Gain Measurements.—W. M. Breazeale. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, pp. 31–34.) "The development of microwave receivers with a low-gain converter as the first stage has made it desirable that the noise level and the conversion gain be determined independently of the following intermediate-frequency amplifier. Often this converter is a crystal with a conversion gain less than one. This paper discusses some of the general procedures that have been used to measure microwave-converter noise levels and conversion gains."

621.396.823 **2230**

Interference Problems arising from Industrial Electronic and Electromedical Apparatus.—(*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 57–58.) Summary of I.E.E. Radio Section discussion, led by M. R. Gavin.

621.396.823 : 621.327.43 **2231**

Radio Interference by Fluorescent Lamps.—(*Light & Lighting*, Feb. 1947, Vol. 40, No. 2, p. 40.) A summary of a paper by L. F. Shorey & S. M. Gray at the recent Convention of the American Illuminating Engineering Society. The authors conclude that interference can be reduced to a negligible amount by a combination of screening and filtering.

621.396.96.029.62 : 523.3 **2232**

Radio Reflection from the Moon [at 120 Mc/s].—Z. Bay. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 196, 198.) An electrochemical method of cumulation was used to distinguish the signal from noise. The equipment is also being used to measure solar radiation at 2.6 m.

STATIONS AND COMMUNICATION SYSTEMS

621.3 (494) "1945" **2233**

High-Frequency, Communications, and Remote Control Engineering.—(*Brown Boveri Rev.*, Jan./Feb. 1946, Vol. 33, Nos. 1/2, pp. 43–47.) Progress in 1945 in the design of beam and multichannel telephony and telegraphy equipment, u.h.f. f.m. radio systems for the police and fire services, short-wave telephony and telegraphy transmitters of 1–10 kW, broadcasting transmitters, h.f. heating, carrier telephony, and remote control equipments.

621.391.63 **2234**

Transmission with Light.—R. H. Milburn. (*Radio Craft*, Jan. 1947, Vol. 18, No. 4, pp. 62–63, 139.) For short-range communication an NE-30 neon tube is used as the light source, with a suitable lens system for focusing the light on the receiving photoelectric cell. Modulation of the light is effected by a 3-stage amplifier of conventional design fed from a microphone or gramophone pickup. With a simple RC amplifier following the photocell, good reproduction is obtained at short distances.

621.394.44 : 621.396.619.16 **2235**

The Basic Principles of Multi-Channel Transmission with Modulated Impulses.—H. J. v. Baeyer. (*Brown Boveri Rev.*, March 1946, Vol. 33, No. 3, pp. 65–69.) By modulating periodic pulses several channels can be 'multiplexed' on the same carrier and resolved at the receiver by phase-discriminating equipment; the pulse recurrence frequency must be at least twice the highest frequency in the intelligence to be communicated.

621.396.619.029.6 **2236**

Propagation of Amplitude- and Frequency-Modulated Short-Wave Oscillations.—E. Hölzler, F. H. Gecks & G. Kamphausen. (*Elektrotech. Z.*, 20th April 1944, Vol. 65, Nos. 15/16, pp. 133–138.) Single-sideband transmission with carrier suppression, as used between Berlin and New York, reduces very considerably the distortion and signal variations often found in short-wave communication. The use of f.m. for further noise reduction introduces new disturbances whose origin is explained by multipath transmission. The technical aspects of such effects are discussed. Results with model equipment indicate the possibility of evaluating directly the disturbing effect of neighbouring transmitters.

621.396.619.13 **2237**

Frequency Modulation.—K. R. Sturley. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 84–88.) Discussion of 4047 of 1945.

621.396.619.13 **2238**

Frequency-Modulation in Broadcasting.—(*Nature, Lond.*, 4th Jan. 1947, Vol. 159, No. 4027, pp. 15–16.) Summary of 3751 of 1946 (Kirke).

621.396.619.13 **2239**

A New System of Frequency Modulation.—R. Adler. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, pp. 25–31.) Describes the development of the phasitron modulator in which a radial electron stream in a concentric structure is shaped into a wavelike pattern which progresses continuously round the cathode. The axial modulating magnetic field curves the paths of the electrons in the plane of rotation so that the streams of electrons reaching the segmented anode are advanced or retarded according to the magnetic field. The faults of early models and the steps taken to correct them are analysed.

621.396.619.13 **2240**

Some Investigations on Oscillations with Frequency Modulation. [Thesis]—Stumpers. (*See* 2221.)

621.396.619.13 : 621.396.712 **2241**

B.B.C. and F.M.—(*Wireless World*, March 1947, Vol. 53, No. 3, p. 95.) The B.B.C. has invited tenders for a f.m. transmitter for experimental transmissions; such transmissions are at present being radiated each evening from 6 p.m. to midnight on 90.3 Mc/s from Alexandra Palace.

621.396.65 **2242**

Two Multichannel Microwave Relay Equipments for the United States Army Communication Network.—R. E. Lacy. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, pp. 65–70.) Sets AN/TRC-5 and AN/TRC-6 use pulse-position modulation of 1-μs pulses giving 8 channels with a pulse rate of 8 000 pulses per sec. Audio performance and radiation characteristics are given.

621.396.65 Vanguard **2243**

Radio Facilities in H.M.S. Vanguard.—(*Elect. Times*, 30th Jan. 1947, Vol. 111, No. 2884, p. 151.) A long-range duplex transmitter, type DS10, provides c.w. and telephone channels for two-way communication with Great Britain and South Africa. For another account see *Electrician*, 31st Jan. 1947, Vol. 138, No. 3583, pp. 346–347.

621.396.72 **2244**

Planning and Constructing a 1-kW Studio-Transmitter Building.—H. G. Stephenson, Jr. (*Communications*, Feb. 1947, Vol. 27, No. 2, pp. 9–11 . . 51.) Details of a station erected at Centralia, Illinois, including studios isolated from external noise, with baffles in the forced ventilating system, soundproof teletype room, etc.

621.396.72.029.62 **2245**

H.F. A.M. Broadcasting for Small Communities.—S. Tarzian, A. Valdettaro & M. Weigel. (*Communications*, Jan. 1947, Vol. 27, No. 1, p. 27.) A report of results obtained in hilly limestone country round Bloomington, Indiana. The aerial consisted of 8 coaxial units mounted vertically and hanging from the top of a 200-ft tower. With a radiated power of 200 W on a frequency of 87.75 Mc/s, field strengths of 120 μV/m have been measured at a point 21 miles from the transmitter. The advantages of such systems for local broadcasting are stated. Summary of a Rochester Fall Meeting paper.

621.396.931 **2246**

The Development of Police Communications.—S. C. Austin. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1947, Vol. 8, No. 1, pp. 4–12.) A comprehensive account of methods of radio communication from early to present day systems, as used in Australia. The general communications networks of the chief cities are described, with more detailed accounts of the mobile equipment for patrol cars, launches, motor cycles and for personal use; descriptions and photographs of the equipment are given and the frequencies used are stated. Early types were c.w. only, but this has been superseded by telephony. The chief difficulties encountered, such as the elimination of frequency drift, and the methods used to overcome them are described. Initial f.m. experiments on v.h.f. are mentioned.

621.396.931.029.6 **2247**

V.H.F. Space Radio Train Communication.—L. G. Sands. (*Telegr. Teleph. Age*, Feb. 1947, Vol. 65, No. 2, pp. 10, 12 . . 31.) Frequency bands of 158–162 Mc/s and 186–216 Mc/s are used. Experiments have been carried out with frequencies near 2 600 Mc/s. Train-to-train range varies between 4 and 12 miles and station-to-train range between 10 and 30 miles, the transmitter power being about 10 W.

SUBSIDIARY APPARATUS

621.3.087 : 621.38 **2248**

Electronic Recording Instruments.—(*Elect. Engng, N.Y.*, Jan. 1947, Vol. 66, No. 1, pp. 36–44.) Summary of the following talks given at a session of the 1946 A.I.E.E. Summer Convention in Detroit devoted to electronic recording instruments for potentiometric and bridge-type measurements: A Brief History [of electronic recording instruments], by W. R. Clark. Electronically Operated Instruments for Industrial Measurement, by A. J. Hornfeck. D.C. to A.C. Conversion Systems, by W. P. Wills. The Input Transformer Problem, by A. J. Williams, Jr. A New High-Speed Recording Potentiometer, by V. L. Parsegian. Sweep-Balance Recorders, by G. Keinath & R. K. Hellmann.

621.316.53.029.5/.6 **2249**

A Design of Heavy-Current Contact, particularly for Radio-Frequency Use.—A. J. Maddock. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 52–54.) A high-pressure, small-area type, capable of carrying 75 A at 20 Mc/s and 150 A at power frequencies.

621.316.546.032.43 : 621.317.329 **2250**

Potential Distribution at the Igniter of a Relay Valve with Mercury Cathode.—N. Warmoltz. (*Philips tech. Rev.*, Nov. 1946, Vol. 8, No. 11, pp. 346–352.) Curves are given showing the field strength at the mercury surface for different thicknesses of the igniter wall. The measurements were made on a 100 : 1 scale-model. The mechanism of the ignition is discussed.

621.317.79.087.6 **2251**

New Statistical Recorders of Electromagnetic Variations.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 6th Nov. 1944, Vol. 219, No. 18, pp. 443–445.) Pen recorders based on the method of multiple time constants previously noted (1336 of 1942). Three identical elements are generally included for recording either on three wavelengths or for three components of an electromagnetic field. Each element comprises a coil suspended by a steel wire in the air-gap of a magnet, with oil damping. Such an arrangement has a principal time constant τ and a much smaller secondary constant τ_s, which is equal to the ratio of the moment of inertia of the system to the damping coefficient. If T is the period of natural oscillations, $T = 2\pi\sqrt{\tau\tau_s}$. A sensitivity of 1 mm/$\mu$A can be obtained with a restoring couple of 0.6 × 10^6 c.g.s. units per radian, a coil resistance of 15 500 Ω, magnet flux 1.14 × 10^{10} maxwells and natural period 17 sec.

621.394.324 : 629.135 **2252**

Airborne Teletype Printer.—R. A. Vanderlippe. (*Telegr. Teleph. Age*, Feb. 1947, Vol. 65, No. 2, pp. 6–8.) Model 31, weight 35 lb, can be used in any two-way voice installation. Operation of the keyboard modulates a r.f. signal at a frequency between 1 615 and 1 275 c/s. Some of the energy is fed back into the receiver, giving a local copy of the message. On reception the signal is passed through a band-pass filter and an amplitude-limiting circuit to a frequency discriminator yielding a positive voltage for marking and a negative voltage for spacing.

621.396.664 : 621.396.96] : 621.392.029.64 **2253**
High-Speed Waveguide Switch.—D. K. Bishop. (*Wireless Engr*, March 1947, Vol. 24, No. 282, pp. 67–70.) Alternate r.f. pulses are switched at a rate of 500 per second into the two aerials of a radar installation. The switch consists of a T-junction in a rectangular waveguide transmitting the H_{10} mode, the side arms being closed alternately by vanes on two disks rotated in synchronism with the pulses. The effective open time of the switch, 1 550 μs, is long enough to receive reflected pulses from targets at ranges up to 150 miles. The switch operates on wavelengths of 9.8–10.2 cm and will handle a peak power of 500 kW.

621.396.665.029.64 **2254**
An Attenuator of "S"-Band Energy.—H. R. Meahl. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 211–213.) A 4-inch length of concentric line has, in its inner conductor, a 1-inch gap which can be partially bridged by a hollow metal cylinder sliding on the inner conductor. The gap acts as a waveguide whose dimensions can be varied to give attenuations from 6–50 db.

621.396.682 : 621.314.634 **2255**
Voltage Multiplier Circuits with Selenium Rectifiers.—E. W. Chadwick. (*Communications*, Jan. 1947, Vol. 27, No. 1, p. 14.) Selenium rectifiers have a lower impedance than corresponding valves in a high-voltage supply unit and may be used with larger capacitors, thus giving better regulation. Voltage doubler and tripler circuits permit television sets to be run from a 115-V mains supply without a mains transformer.

TELEVISION AND PHOTOTELEGRAPHY

621.396/.397].621.004.67 **2256**
The Servicing of Radio and Television Receivers.—Williams. (*See* 2224.)

621.397 **2257**
The Development of Photo-Telegraphy.—W. C. Lister. (*Electronic Engng*, Feb. 1947, Vol. 19, No. 228, pp. 37–43.) Apparatus of historical interest is briefly described with illustrations. Transmitting and receiving processes used in various workable systems are compared, and possible methods of synchronization are discussed.

621.397 **2258**
New Phototelegraph Equipment : Part 1—A Picture System for the Press.—(*Electronic Engng*, Feb. 1947, Vol. 19, No. 228, pp. 46–48.) A description of the Muirhead-Jarvis equipment, including the mechanical design of the scanning and optical systems and the electrical arrangements for synchronization and phasing. Selection of scanning rate and drum speed gives a choice of time of transmission and quality of reproduction for a given picture size.

621.397 **2259**
New Phototelegraph Equipment : Part 2—Cable & Wireless Facsimile Equipment.—(*Electronic Engng*, Feb. 1947, Vol. 19, No. 228, pp. 49–50.) A brief description of a crystal-controlled system using frequency modulation of an audio-frequency subcarrier. The terminal equipment is designed for alternative reception or transmission. Details of the scanning mechanism and the optical system are given. Transmission may be over any line or radiotelephone channel.

621.397.26 Vanguard **2260**
Picture Transmission by Radio.—(*Elect. Times*, 30th Jan. 1947, Vol. 111, No. 2884, p. 145.) Apparatus installed in H.M.S. *Vanguard* and working with the ship's transmitter. A constant-speeed motor drives the drum carrying the picture, and the traversing head gives a 135-lines/inch scan. For another account see *Electrician*, 31st Jan. 1947, Vol. 138, No. 3583, pp. 346–347.

621.397.335 **2261**
Television Synchronizing.—W. T. Cocking. (*Wireless World*, March 1947, Vol. 53, No. 3, pp. 90–94.) A survey of some of the problems, with a detailed discussion of the action of a slicer, or double limiter, circuit to minimize the effect of pulling on whites.

621.397.5 : 621.392.4.08 : 621.396.67 **2262**
Application of Transmission Line Measurements to Television Antenna Design : Parts 1 & 2.—G. E. Hamilton & R. K. Olsen. (*Communications*, Jan. & Feb. 1947, Vol. 27, Nos. 1 & 2, pp. 8, 9..36 & 32..40.) The first two of a series of papers. Analysis is given for the case of a transmission line terminated by a complex impedance, with particular reference to standing-wave ratio, angular position of voltage maximum and minimum and the surge impedance of the line. Actual measurement techniques are described, with practical details.

621.397.5 : 621.396.619.16 **2263**
Transmission of Television Sound on the Picture Carrier.—G. L. Fredendall, K. Schlesinger & A. C. Schroeder. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, p. 46.) Discussion by E. R. Kretzmer of 1382 of 1946, analysing pulse-width modulation when the time shift of a pulse edge varies as the instantaneous modulating signal at the instant at which the pulse edge actually occurs.

621.397.5 : 778.5 **2264**
Television and the Motion Picture Theater.—L. B. Isaac. (*J. Soc. Mot. Pict. Engrs*, Dec. 1946, Vol. 47, No. 6, pp. 482–486.) A discussion, from the exhibitors' standpoint, of the various problems involved.

621.397.5 (44) **2265**
Television in France.—A. Ory. (*Wireless Engr*, March 1947, Vol. 24, No. 282, p. 93.) Correction of a statement in an article abstracted in 270 of January to the effect that the equipment of the R.D.F. television studio is all of German manufacture. This statement is erroneous, as the whole of the equipment was both designed and manufactured in France.

621.397.5 (71) **2266**
Television and F. M. Plans for Canada.—G. W. Olive. (*Communications*, Jan. 1947, Vol. 27, No. 1,

pp. 20–21.) Discussion of problems and future possibilities.

621.397.6 **2267**

Some Special Tubes used in Television.—(*Télévis. franç.*, Feb. 1946, No. 10, pp. 12–13.) Diagrams and brief descriptions of principal characteristics.

621.397.62 **2268**

Television Receiving Equipment. [Book Review]—Iliffe & Sons, London, 2nd edn, 354 pp., 12s. 6d. (*Wireless World*, March 1947, Vol. 53, No. 3, p. 89.) Brought up to date, with many chapters re-written and some additional material.

TRANSMISSION

534.78 **2269**

More on Speech Clipping.—Smith. (*See* 1981.)

621.317.761 : 621.396.61 **2270**

The BC-221 Frequency Meter as a V.F.O.—H. W. Johnson. (*QST*, March 1947, Vol. 31, No. 3, pp. 43–47.) Details of its adaptation without impairing its use as a frequency meter. See also 3099 of 1946.

621.396.61.029.62 **2271**

Low-Cost Six-Meter 'Phone.—C. V. Chambers. (*QST*, March 1947, Vol. 31, No. 3, pp. 13–17.) A description and circuit diagram of a 15-W 50-Mc/s transmitter. The second harmonic of a 25-Mc/s crystal is obtained from a triode-tetrode oscillator with sufficient output to drive directly a low-power amplifier.

621.396.615.142 **2272**

Current and Power in Velocity-Modulation Tubes.—L. J. Black & P. L. Morton. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1947, Vol. 35, No. 1, p.43.) Discussion by P. J. Wallis and S. G. Tomlin of 3843 of 1944.

621.396.619.13/.14 **2273**

Development of the Cascade Phase Shift Modulator [for f.m. transmitters].—(*Radio, N.Y.*, Jan. 1947, Vol. 31, No. 1, pp. 11–15.) Distortion in phase shift modulators may occur as nonlinearity of phase modulation or as the result of amplitude modulation of the signal. The paper describes in detail a circuit employing a 100-kc/s crystal oscillator and six pentode-triode resistance-controlled modulators followed by frequency-multiplying stages having a factor of 97.2. The output signal has less than 1% distortion for 100 kc/s deviation at audio frequencies above 50 c/s.

621.396.619.14 **2274**

Wide-Angle Phase Modulator.—H. K. Bradford. (*Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 100–103.) "Technique for phase modulating a crystal-controlled carrier, whereby two components of fixed phase difference are amplitude modulated and added to give the output, is described. Circuit can be used to give frequency modulation, or modified to give amplitude modulation."

621.396.619.231.029.62 **2275**

Investigations on Suppressor Grid Modulation at Ultra-High Frequency.—S. K. Chatterjee. (*Electrotechnics*, Dec. 1946, No. 19, pp. 41–51.) An experimental investigation at 40 Mc/s. Main results are high overall efficiency (20%) and good linearity of the modulation characteristic.

VALVES AND THERMIONICS

621.314.632 : 546.289 **2276**

Properties of Welded Contact Germanium Rectifiers.—H. Q. North. (*J. appl. Phys.*, Nov. 1946, Vol. 17, No. 11, pp. 912–923.) Construction and tests of these rectifiers are described. Welded contact has advantages of mechanical stability, very low forward and high backward resistance, low contact capacity at zero bias, logarithmic d.c. characteristic over a wide current range and high harmonic power output as a microwave generator. Loss and noise ratio measurements are also described.

621.316.722.1 : 621.384.5 **2277**

A Voltage Stabilizing Tube for Very Constant Voltage.—T. Jurriaanse. (*Philips tech. Rev.*, Sept. 1946, Vol. 8, No. 9, pp. 272–277.) By using a carefully prepared molybdenum cathode and depositing a thick layer of molybdenum on the tube walls by cathode sputtering, the stabilized voltage varies by not more than a few volts for different samples of the same type, and the variation with time is not more than ½ V per 1 000 working hours. Ambient temperature, also, has little effect on the working voltage.

621.383 **2278**

Elimination of the Residual Current in Photoelectric Cells.—A. Lallemand. (*C. R. Acad. Sci., Paris*, 18th Nov. 1946, Vol. 223, No. 21, pp. 856–857.) Difficulties due to residual current can be very considerably reduced by using only a small portion of the cathode, with electrostatic or magnetic lenses between it and the corresponding portion of the anode, which can be pierced and provided with a small collecting disk behind the hole. A 5-stage multiplier on this principle has been constructed, with magnetic lenses forming an electronic image of the photocathode successively on each multiplier, the residual current from the small collecting electrode being 80 times less than from the guard electrode. With this device it has been possible to show that the light reflected or diffused by a photoelectric layer is by no means negligible, and also to measure the gain realized by giving the photosensitive layer in an ordinary cell the form of a black body.

621.383 : 537.533.8 **2279**

Application of Secondary Emission of Electrons to Multiplier Tubes.—A. Lallemand. (*Rev. sci., Paris*, Aug. 1946, Vol. 84, No. 3255, pp. 131–136.) A review of the phenomena of secondary emission from pure metals, alloys and complex layers, and their practical use in electron multipliers.

621.383.42 **2280**

Parallel Operation of Several Barrier-Layer Selenium Photocells.—M. Delattre. (*C. R. Acad. Sci., Paris*, 17th Jan. 1944, Vol. 218, No. 3, pp. 112–113.)

621.383.42 : 535.215.4 **2281**

Investigation of Uniformity of Sensitivity Distribution over the Surface of Selenium Photocells.—I. A. Vladimirov. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 499–502. In Russian with English summary.) Apparatus is described for recording this sensitivity distribution.

621.383.42 : 535.215.6 **2282**

On the Gaseous Nature of the Non-Conducting Layer in Selenium Photocells.—D. I. Arkadiev. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 503–505. In Russian with English summary.) If a selenium rectifier photocell is placed in a high vacuum, the only way in which its electrical and photoelectric properties can be changed is by the formation of selenium amalgam when the mercury vapour is not completely frozen out. Previous suggestions that the rectifier layer consists of adsorbed gaseous molecules or other volatile compounds are not supported by these experiments.

621.383.5 : 620.196 **2283**

The Influence of Impurities on the Rectifier Photo-effect of Cuprous Oxide.—V. E. Laškarev & K. M. Kosonogova. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 478–493. In Russian with English summary.) If cuprous oxide cells are prepared by reduction during tempering in salt solutions (of Li, Na, K, Be, Zn, Pb, U) an extra maximum occurs in the red and infra-red region of the spectrum (0.75–1 μ). The position of the maximum is determined by the content of the metallic impurities introduced and is the same for all the above metals. For large impurity contents the principal maximum at $\lambda = 0.54\,\mu$ disappears. The introduction of impurities causes an abrupt increase in the absorption by cuprous oxide in the red region of the spectrum; it has a marked effect on the dissociation work of the barrier layer. A thermoprobe method reveals, in Cu_2O photocells, the existence, between the upper electrode and the barrier layer, of a layer of oxide which has electronic conductivity. Analysis of the results suggests a new structural scheme for Cu_2O cells. The stability of these cells when temperature varies is increased if impurities are introduced. For relatively large amounts of impurity this stability is of the order of fifty times that for photocells prepared by cathode sputtering. All the observed phenomena can be explained on the assumption that the electropositive impurities result in localized levels whose height is greater than that of the oxygen levels in Cu_2O.

621.385.029.63/.64 **2284**

Theory of the Beam-Type Traveling-Wave Tube.—J. R. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 111–123.) The theory is developed assuming small signals. The equations predict three forward waves, one increasing and two attenuated, and one backward wave which is little affected by the electron beam. The dependence of the wave propagation coefficients on voltage, current, circuit loss, and other properties of the transmission mode, together with expressions for gain, noise and power are given and illustrated graphically. Appendices deal with (*a*) the field in a uniform transmission system due to impressed current (such as an electron stream) in terms of the parameters of the transmission modes, and (*b*) wave propagation along a helix.

621.385.029.63/.64 **2285**

Traveling-Wave Tubes.—J. R. Pierce & L. M. Field. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 108–111.) Describes a valve with a gain of 23 db at 3 600 Mc/s and power output of 0.2 W. The bandwidth between the 3-db points is 800 Mc/s. A qualitative account of its operation is included; for theory see 2284 above.

621.385.029.63/.64 : 621.396.615.14 **2286**

The Traveling-Wave Tube as Amplifier at Microwaves.—R. Kompfner. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, pp. 124–127.) The inner conductor of a concentric line consists of a wire helix such that the velocity of propagation is about one-tenth of the velocity of light. If an electron beam of voltage of the order of 2 500 and about the same velocity as that of the travelling field is shot along the axis of the helix, the line acts as an amplifier of r.f. power passing along it. A description of the early development of these valves in England and expressions for power gain and noise factor are given.

621.385.1 **2287**

Time Constant of the Ignition of the Discharge in Rarefied Gases.—J. Moussiegt. (*C. R. Acad. Sci., Paris*, 28th Oct. 1946, Vol. 223, No. 18, pp. 659–661.) A simple theory is given, with formulae, in general agreement with the results previously reported (940 and 941 of March) for the effect of various factors on the value of the current maximum for intermittent gas discharges.

621.385.1.029.62/.63 + 621.396.6 **2288**

Radar Vacuum-Tube Developments.—J. J. Glauber. (*Elect. Commun.*, Sept. 1946, Vol. 23, No. 3, pp. 306–319.) The development, and factors influencing the design, of high power transmitting triodes for pulsed and c.w. operation in the 200–600 Mc/s band are discussed.

Brief details of air-cooled valves suitable for pulsed operation are given below:—

L200: operating frequency 200 Mc/s; power output per pair 150 kW (duty cycle 0.01); directly-heated thoriated tungsten cathode; squirrel-cage type grid connecting to a ring seal; re-entrant anode.

L400: operating frequency 400 Mc/s; generally similar to L200 but shorter anode.

L600E: operating frequency 600 Mc/s; power output 25 kW.

8C22: operating frequency 400 Mc/s; directly-heated cathode specially arranged to reduce electromechanical force between adjacent elements thereof; filament power 1.35 kW; power output 500 kW.

6C23: operating frequency 600 Mc/s; power output 600 kW; indirectly-heated cathode requiring lower filament power input than 8C22.

Brief details of valves suitable for c.w. operation are given below:—

6C22: directly-heated water-cooled valve, having smaller grid-to-filament spacing than L600E and larger filament area; output power 250 W as an oscillator at 600 Mc/s and 500 W as an amplifier with a driving power of 100 W.

L600NR: air-cooled version of 6C22.

8C23: An improved valve developed from 8C22, having modified grid structure and reduced anode diameter. Incomplete tests using forced air-cooling indicate a power output of 500 W at 400 Mc/s with an anode dissipation of 1 kW: with water cooling, power outputs of 2.7 kW and 1 kW (anode dissipation 5 kW) are anticipated at 400 and 600 Mc/s respectively.

6C23 : Early tests on this valve under c.w. operating conditions are described.

621.385.1.032.216 **2289**

Periodic Variations of Anode Current in Valves with Oxide Cathodes.—R. Champeix. (*C. R. Acad. Sci., Paris,* 13th Nov. 1946, Vol. 223, No. 20, pp. 786–788.) The anode current in some of these valves varies periodically, the periods observed ranging from 15 minutes to 4 hours. In some cases the current curves are approximately sinusoidal, but more frequently the maxima, which may be three times the minima, are sharply peaked. The effect is observed much more often with low than with high cathode temperatures and appears to be related to modifications of the cathode saturation current. See also 3810 of 1946.

621.396.615.142 **2290**

Transit-Time Effects in Ultra-High-Frequency Class-C Operation.—W. G. Dow. (*Proc. Inst. Radio Engrs, W. & E.,* Jan. 1947, Vol. 35, No. 1, pp. 35–42.) " Effects discussed are electron-transit reactance ; electron-transit phase-delay angle ; cathode back-heating ; use of a screen grid to improve efficiency ; changes in optimum shunt impedance ; secondary emission ; and anode back-heating by secondary electrons. It is pointed out that by increasing voltage and current density simultaneously the frequency and power can be raised without sacrificing efficiency or bandwidth. An equivalent circuit is described which takes account of certain important transit-time effects."

621.396.615.142 **2291**

A Wide-Tuning-Range Microwave Oscillator Tube.—J. W. Clark & A. L. Samuel. (*Proc. Inst. Radio Engrs, W. & E.,* Jan. 1947, Vol. 35, No. 1, pp. 81–83.) Describes the design of the 2K48 reflex velocity-modulation valve and its associated cavity resonators tuning from 3 000 to 6 000 Mc/s and 5 000 to 10 000 Mc/s respectively.

621.396.615.142 **2292**

Current and Power in Velocity-Modulation Tubes.—Black & Morton. (*See* 2272.)

621.397.6 **2293**

Some Special Tubes used in Television.—(*Télévis. franç.,* Feb. 1946, No. 10, pp. 12–13.) Diagrams and brief descriptions of principal characteristics.

MISCELLANEOUS

001.4 : 621.38 **2294**

Is "Electronics" Overworked ?—"Cathode Ray". (*Wireless World,* Feb. 1947, Vol. 53, No. 2, pp. 43–45.)

061.31 **2295**

British Commonwealth Scientific Official Conference, London, 1946. Report of Proceedings. [Book Review]—H.M. Stationery Office, London, 73 pp., 1s. 3d. Terms of reference : " To consider the best means of ensuring the fullest possible collaboration between Civil Government Scientific Organizations of the Commonwealth and to make formal recommendations for the approval of the Governments represented ".

061.6 **2296**

20th Annual Report of the Council of the [British] **Institution** [of Radio Engineers].—(*J. Brit. Instn Radio Engrs,* July/Aug. 1946, Vol. 6, No. 4, pp. 130–142.)

061.6 : [526+55] " 1946.07.29/.08.02 " **2297**

Summary Report on the Extraordinary General Assembly of the International Union of Geodesy and Geophysics (IUGG), Cambridge, England, July 29 to August 2, 1946.—J. M. Stagg. (*Terr. Magn. atmos. Elect.,* Dec. 1946, Vol. 51, No. 4, pp. 509–515.)

371.3 : 621.3 **2298**

I.E.E. and Further Education Grants.—(*Electrician,* 8th Nov. 1946, Vol. 137, No. 3571, p. 1292.) The Ministry of Labour scheme enables university or I.E.E. graduates, whose war service has prevented completion of practical training, to take a specially designed course.

371.3 : 621.3 **2299**

E. R. A. Apprenticeships.—(*Elect. Rev., Lond.,* 7th March 1947, Vol. 140, Nos. 3613/3615, p. 342.) This scheme, involving attendance at college for one or two days each week, whilst not a substitute for full-time university training, makes a useful contribution to the training of electrical engineers.

384 : 654.196(73) **2300**

U.S. Radio Statistics, 1947.—(*Tele-Tech,* Jan. 1947, Vol. 6, No. 1, p. 59.) A table of output of broadcast receiving sets from 1922 to 1946, and of economic statistics for 1946.

519.283 : 62 **2301**

Engineering and Quality Control.—P. L. Alger. (*Elect. Engng, N.Y.,* Jan. 1947, Vol. 66, No. 1, pp. 16–19.) Describes a systematic procedure for taking samples, measuring them, and plotting the results on charts so that variations of importance can be noted before they become serious. The fundamental laws of chance on which this procedure is based are briefly discussed. See also 2421 of 1946.

621.38(083.72) **2302**

" Tron ".—(*Toute la Radio,* Jan. 1947, Vol. 14, No. 112, p. 43.) Short definitions of 30 of the 'tron' family, many of which are simply trade names.

621.396.621.004.67 **2303**

Manual of Radio Practice for Servicemen. [Book Review]—E. G. Beard. Philips Electrical Industries of Australia, Sydney, 496 pp. (*Proc. Instn Radio Engrs, Aust.,* Nov. 1946, Vol. 7, No. 11, p. 33.) A comprehensive treatment which should prove useful both to the serviceman and to the radio engineer.

621.396.97 : 06.013 **2304**

Broadcasting. Copy of the Licence and Agreement between His Majesty's Postmaster General and the British Broadcasting Corporation, Nov. 29 1946. [Book Notice]—H.M. Stationery Office, London, 3d. (*Govt Publ., Lond.,* Dec. 1946, p. 6.)

621.396.97 : 06.013 **2305**

Broadcasting. Draft of Royal Charter for the Continuance of the British Broadcasting Corporation for which the Postmaster General proposes to apply. [Book Notice]—H.M. Stationery Office, London, 2d. (*Govt Publ., Lond.,* Dec. 1946, p. 6.)

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2306**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 263–277.)

534 **2307**

Program of the Thirty-Second Meeting of the Acoustical Society of America.—(*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 283–293.) Brief summaries are given of papers read. These include : The Propagation of Underwater Sound at Low Frequencies as a Function of the Acoustic Properties of the Bottom, by J. M. Ide, R. F. Post & W. J. Fry. Measurement Conditions influencing the Front-to-Back Discrimination of an Underwater Hydrophone, by L. N. Miller. An Acoustic Lens for Underwater Sound, by R. Herr. Ultrasonic Lenses and Transmission Plates, by P. J. Ernst. Surface Reflection of Short Ultrasonic Pulses in the Ocean, by R. J. Urick & H. L. Saxton. Reflection of Sound from the Sea Surface, by L. N. Liebermann. Reflection of Sound from Rough Surfaces, by P. G. Bergmann. Supersonic Radar Trainers, by C. E. Teeter, Jr. Attenuation of Sound in Water, by D. A. Wilson & L. N. Liebermann. Convex Wood Splays for Broadcast and Motion Picture Studios, by M. Rettinger. Disk Recording Studio Acoustics, by J. Y. Dunbar & L. Green, Jr. Review of Criteria for Studio Design, by G. M. Nixon & H. M. Gurin. A System for Reducing Scratch in Record Reproduction, by R. W. Carlisle. A Method of Reducing Amplitude Distortion in Engraving Lateral Electrical Transcriptions, by C. E. Harrison. On the Absolute Calibration of Phonograph Test Records by means of Light Patterns, by W. Wathen-Dunn. Some Factors influencing the Choice of a Medium for Magnetic Recording, by L. C. Holmes. Design Problems on Magnetic Recording Equipment, by S. J. Begun. Some Physical Aspects of Magnetic Recording, by O. Kornei. Wow Meter, by W. W. Hansen. Master Wire Recorder, by J. S. Boyers & R. E. Zenner. Mechano-Electronic Transducer, by H. F. Olson.

534.133 + 621.396.611.21.016.2 **2308**

High Intensity Ultrasonics : The Power Output of a Piezoelectric Quartz Crystal.—Epstein, Andersen & Harden. (*See* 2442.)

534.22 **2309**

Wavelength of Sound.—B. W. Henvis. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 134, 136.) A table of the velocity of sound in various solids, liquids and gases, with an abac from which the wavelength can be found for any frequency from 10 c/s to 100 Mc/s.

534.24 : 551.510.52 **2310**

[Sound] **Echoes from the Atmosphere.**—(*Bell Lab. Rec.*, Feb. 1947, Vol. 25, No. 2, pp. 75–77.) For a more detailed account of sodar see 330 of February.

534.321.9.001.8 **2311**

Ultrasonics, a New Tool.—(*Electronics*, March 1947, Vol. 20, No. 3, pp. 190..194.) A short account of the application of supersonic methods to problems of emulsification, catalysis, chemical reactions, gels, degassing of liquids, physiology and homogenizing processes.

534.321.9.001.8 **2312**

Ultrasonic Garage-Door Opener.—B. A. Andrews. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 116–118.) Uses a 25-kc/s vacuum-type whistle on the car and a 5-valve amplifier, with limiter and discriminator, to operate a relay in the circuit of the motor operating the door.

534.846 **2313**

Room Acoustics.—A. Moles. (*Radio franç.*, 1947, No. 4, pp. 13–22.) A compromise is usually necessary between reverberation time, power and speech intelligibility. The elimination of interferences can often be achieved by tests carried out on scale models, and by the judicious use of absorbing or scattering materials.

534.862.1 **2314**

Design of Recording Studios for Speech and Music.—G. M. Nixon & J. Volkmann. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 37–39.) Description of a N.B.C. studio designed to obtain a diffuse sound field, thus reducing the importance of reverberation time.

534.862.4 **2315**

Perfect v. Pleasing Reproduction — Discussion.—G. F. Redgrave : F. Slater : B. C. Sewell : F. Duerden : J. Moir. (*Electronic Engng*, April 1947, Vol. 19, No. 230, pp. 115–116.) Comments on 1185 of April and a reply by the author.

534.88 **2316**

Submarine Detection by Sonar.—A. C. Keller. (*Bell Lab. Rec.*, Feb. 1947, Vol. 25, No. 2, pp. 55–60.)

621.395.623.7 **2317**

The Distribution of Acoustic Power.—L. Chrétien. (*T.S.F. pour Tous*, March–May 1947, Vol. 23, Nos. 221–223, pp. 55–59, 70–74 & 97–99.) A discussion of (*a*) voltage and power amplification using triodes, tetrodes or pentodes, (*b*) output transformer characteristics and matching of loudspeaker impedance for optimum performance, and (*c*) simple measurements on transformers and loudspeakers. To be continued.

621.395.623.73 **2318**

High Efficiency Loud Speaker.—(*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 63, 131.) A 15-W unit for naval use, shock and blast proof and undamaged by deep submersion.

621.395.625.3 **2319**

Wire Recording. A Review of Recent Developments and Applications.—(*Electrician*, 11th April 1947, Vol. 138, No. 3591, pp. 935–936.) Summary of a lecture on "Developments in Magnetic Recording" given by P. T. Hobson to the British Sound Recording Association.

621.395.625.3 **2320**

Magnetophon Recorders.—(*Wireless World*, April 1947, Vol. 53, No. 4, p. 128.) A description of processes involved in manufacturing the tape. Extracted from a British Intelligence Objectives Sub-Committee report. For other abstracts on the magnetophon see 2463 of 1946 and back references.

621.395.625.3 **2321**

New Magnetic Recorder.—(*Wireless World*, March 1947, Vol. 53, No. 3, p. 88.) Another account of the instrument described in *Tele-Tech*, Jan. 1947, Vol. 6, No. 1, pp. 88–89 and 1832 of June.

621.395.625.6 **2322**

Magnetic Sound for Amateur Movies.—(*Electronics*, March 1947, Vol. 20, No. 3, pp. 140, 158.) A fine-grain magnetic coating along one or both edges of the film is unaffected by photographic solutions. The same head is used for recording and reproducing ; it is pressed by a spring against the film while the film rides on a flywheel stabilizer.

AERIALS AND TRANSMISSION LINES

621.315[.211.2+.22 **2323**

Mineral-Insulated Metal-Sheathed Conductors.—F. W. Tomlinson & H. M. Wright. (*J. Instn elect. Engrs*, Part II, Feb. 1947, Vol. 94, No. 37, pp. 84–91.) Discussion on 12 of January.

621.315.687 **2324**

Cable Terminations.—D. B. Irving. (*J. Instn elect. Engrs*, Part II, Feb. 1947, Vol. 94, No. 37, p. 91.) Discussion on 3360 of 1945.

621.392.029.64 + 537.291 **2325**

Generalization of Certain Results relative to the Interaction of Progressive Guided Waves and an Electronic Beam.—P. Lapostolle. (*C. R. Acad. Sci., Paris*, 17th March 1947, Vol. 224, No. 11, pp. 814–816.) Results have previously been given for waves having symmetry of order zero in a guide without loss (1999 and 2003 of July). These are extended to symmetry of order *n* and to guides with loss.

621.392.029.64 **2326**

On the Theory of Excitation of Waveguides.—G. V. Kisun'ko. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 2, pp. 217–224. In Russian.) Calculations of the electromagnetic field in a waveguide are usually based on various simplifying assumptions with regard to the form and distribution of the exciting conductors, distribution of currents in such conductors, shape of the cross-section of the waveguide, etc. The problem is here considered more generally and the field is determined in an ideally conducting cylindrical waveguide of any arbitrary cross-section when the currents in the exciting conductors can be represented by any arbitrary function of coordinates and time. The cases of (*a*) an infinitely long waveguide and (*b*) a waveguide closed at one end by a conducting wall, are considered separately.

621.392.029.64 : 534.1 **2327**

The Interaction of Oscillating Systems with Distributed Parameters.—Krasnooshkin. (*See* 2386.)

621.392.029.64.018.14+621.392.029.64.091 **2328**

Attenuation and *Q* Factors in Wave Guides.—A. G. Clavier. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 436–444.) A theoretical paper which introduces the concepts of attenuation per unit length and *Q* factor as applied to a coaxial line. The argument is generalized to cover the relation between the "attenuation per unit length for each wave structure propagated at a definite velocity in a wave guide, and . . . [the] *Q* factor for a section of guide used as a resonant cavity." For earlier work see 1177 of 1943.

621.392.3 : 621.317.382.08 **2329**

R.F. Generator Load.—Leslie. (*See* 2493.)

621.392.43 : 621.396/.397].62 **2330**

Transmission Line Systems for F.M. and Television Home Receivers.—C. Spear. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 44–46 . . 140.) Matching methods for various aerials.

621.396.67 **2331**

Recent Developments of the Theory of the Aerial : Part 1.—É. Roubine. (*Rev. tech. Comp. franç. Thomson-Houston*, Dec. 1946, No. 6, pp. 5–25.) A presentation, in as elementary a manner as possible, of recent attempts to solve the aerial problem. See also 2012 of July and 2332 below.

621.396.67 **2332**

Recent Theories of the Aerial : Part 3.—É. Roubine. (*Onde élect.*, March 1947, Vol. 27, No. 240, pp. 104–118.) An outline of the theory of

Schelkunoff, discussing the 'interior' and 'exterior' solutions, their combination on the Σ sphere, formulae for the current distribution and input impedance and also aerials of arbitrary section. The elements of Hallén's theory are presented. For parts 1 & 2 see 2012 of July. To be continued.

621.396.67 **2333**

Concerning Hallén's Integral Equation for Cylindrical Antennas.—S. A. Schelkunoff. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 282–283.) Discussion of 851 of 1946. S. Hershfield compares the experimental results of D. D. King (3684 of 1946) and of Brown & Woodward (2207 of 1945) with results calculated from the formulae of R. King & D. Middleton (2141 of 1946) and those of Schelkunoff. R. King, in reply, points out the difficulties of making any such comparison without more precise knowledge of the apparatus and methods used in obtaining the experimental results.

621.396.67 **2334**

Square Loops for Frequency-Modulated Broadcasting at 88–108 Megacycles.—R. F. Lewis. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 415–425.) A practical version of one of the aerial systems described in 1180 of 1946 (Kandoian). The installation of the system is discussed. Its advantages include (*a*) horizontal polar diagram circular to 1 db, (*b*) low overall impedance, (*c*) gain increase by 'stacking', (*d*) ease of construction.

621.396.671 : 538.3 **2335**

Physical Interpretation of Electromagnetic Radiation from an Antenna.—R. W. P. King. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 134.) Summary of Amer. Phys. Soc. paper. A discussion of the conclusions which follow from the erroneous assumptions that the axial distribution of current in a cylindrical aerial is sinusoidal and that the Poynting vector is a true measure of the direction and magnitude of 'energy flow' at every point in space.

621.396.677 **2336**

An Inexpensive 4-Element Array.—V. C. Hale. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 47 . . 82.) Constructional details of a high-gain beam.

621.396.677 **2337**

On the Theory of Directional Radiation with Parabolic Reflectors.—F. Lüdi. (*Helv. phys. Acta*, 6th Sept. 1944, Vol. 17, No. 5, pp. 374–388. In German.) Using Kirchhoff's diffraction formula the radiation patterns in the vertical and horizontal planes are derived when the focus is in the plane of the aperture. The field intensity gain is found to be $8R/3\lambda$, R being the aperture radius, compared with $2.85\ R/\lambda$ given by Darbord's theory (1932 Abstracts, p. 346). Comparison is made with the horn and the saw-tooth aerial; the latter simple system of wires gives the same performance as a mirror.

621.396.67 **2338**

Antennae — An Introduction to Their Theory. [Book Review]—J. Aharoni. Oxford University Press, 265 pp., 25s. (*Wireless Engr*, April 1947, Vol. 24, No. 283, p. 122.) The treatment throughout is based on the work of Hallén, Ryder, King, Harrison, Gray and Schelkunoff. A considerable knowledge of mathematics is assumed, especially of vector algebra.

CIRCUITS AND CIRCUIT ELEMENTS

538.3 : 621.396.694 **2339**

On the Helix Circuit used in the Progressive Wave Valve.—É. Roubine. (*C. R. Acad. Sci., Paris*, 14th April 1947, Vol. 224, No. 15, pp. 1101–1102.) An explicit formula, involving the modified Bessel function of the second kind of zero order, is given for the axial component (E_z) of the electric field. The formula shows that the field is propagated axially with the reduced velocity $v \sin \alpha$, where v is the velocity of electromagnetic waves in free space and α is the angle of the helix. The amplitude of E_z has a maximum value for a certain frequency and a particular value of α See also 2340 below.

538.3 : 621.396.694 **2340**

On the Helix Circuit used in the Progressive Wave Valve.—É. Roubine. (*C. R. Acad. Sci., Paris*, 21st April 1947, Vol. 224, No. 16, pp. 1149–1151.) Replacing the helix by a uniform current distribution on the surface of the cylinder on which the helix is traced, a solution is obtained for the equivalent transmission line, with simple formulae for the power transported, the characteristic impedance and the distributed inductance and capacitance. See also 2339 above.

549.514.51 : 534.133] + 621.396.611.21.012.8 **2341**

Calculation of the Equivalent Constants of a Quartz Plate in Plane Shear Vibration (Type CT, DT).—G. Dumesnil. (*Onde élect.*, Feb. 1947, Vol. 27, No. 239, pp. 42–44.) The equivalent circuits for bars in longitudinal vibration and plates in thickness shear are well known. For a plate in plane shear an expression is found for the equivalent impedance similar to that for thickness vibrations, so that, whatever the frequency, the plate can be treated as a line with distributed constants. Near the resonance frequency the impedance can be considered as a self-inductance L in series with a capacitance. L depends only on the thickness and is proportional to it. Calculated values of L for CT and DT cuts are in good agreement with experimental values.

621.314.2 : 621.392.52 **2342**

The Design of Tuned Transformers.—F. G. Clifford. (*Electronic Engng*, March & April 1947, Vol. 19, Nos. 229 & 230, pp. 83–90 & 117–123.) Three methods are discussed which have proved particularly useful. These are (*a*) to transform the circuit until it has the same configuration as a ladder filter of which the design data are known, (*b*) to evolve design data from a consideration of the impedances presented by one pair of terminals when the other pair is (i) open-circuited and (ii) short-circuited, (*c*) to apply Bartlett's bisection theorem and thereby determine the equivalent symmetrical lattice network for which the design data may be found simply. The last method is a simplification of method (*b*) but is applicable only to tuned transformers which are equivalent to a symmetrical T- or π- section. Examples of the applications of these three methods are given. Design data and characteristics of a number of useful types of low-pass, high-pass and band-pass transformers are tabulated.

621.314.23.042.14.017.31 **2343**

An Approximate Theory of Eddy-Current Loss in Transformer Cores excited by Sine Wave or by

Random Noise.—D. Middleton. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 270–281.) The field equations governing the distribution of electric and magnetic fields in thin rectangular laminae are solved with certain approximations. Curves and formulae are thereby obtained showing the variation in the skin depth and mean eddy current loss with variation in frequency and lamination thickness for both current and voltage-fed transformers.

621.316.86 **2344**

On the Mechanism of Voltage-Dependent Resistors.—A. Braun & G. Busch. (*Helv. phys. Acta*, 24th Oct. 1942, Vol. 15, No. 6, pp. 571–612. In German.) Two effects are important in explaining the nonlinear current-voltage characteristic and the hysteresis loop of granular carborundum: (*a*) passage of electrons through impurity layers to positions of higher electric field strength and (*b*) temperature dependence of the conductivity of the impurity layers. These effects are confirmed by experiment and serve as a basis for a theory of the characteristic.

621.317.755.087.35 : 578.088.7 **2345**

A New 4-Way or 6-Way Electronic Commutator.—M. Bladier. (*Radio en France*, 1947, No. 3, pp. 8–14.) Describes, with circuit diagram, a device enabling four (or six) electrical effects to be observed simultaneously on a single c.r.o. The device has proved useful in electro-encephalography.

621.318.572 : 621.317.761 **2346**

A Pulse Counter Circuit and Its Adaptation as a Frequency Meter.—R. Lemas. (*Télévis. franç.*, March 1947, No. 23, Supplement *Électronique*, pp. 4–5, 17.) The pulses, of any shape or amplitude, are used to derive a series of pulses of the same recurrence frequency and of uniform shape and amplitude. This is done by means of a capacitor connected to the anode of a thyratron and charged from a constant voltage d.c. source through a suitable resistance. Each pulse triggers the thyratron and thus causes partial discharge of the capacitor through a milliammeter in the thyratron cathode lead. The milliammeter has a highly damped movement, and integrates these partial discharges; its deflection is directly proportional to the pulse recurrence frequency. Methods are given for calculating the capacitance for various frequency ranges and also an appropriate value for the resistor. A complete circuit diagram is given for a 3-range instrument for pulse recurrence frequencies up to 100, 1 000 and 10 000 per sec respectively, the ranges being determined by the capacitor in use. With a relatively high value of the time constant of the charging circuit, the linear relation between milliammeter deflection and pulse recurrence frequency no longer holds. Such an arrangement has certain advantages, since it tends to keep the percentage error of frequency measurement constant.

For frequency measurement of sine waves, rectangular waves are derived and used to produce a series of positive and negative pulses, which are applied to the counter circuit. This only responds to the positive pulses and hence registers the correct sine-wave frequency. Practical circuit details are given.

621.319.4 : 621.315.59 : 621.315.616.92 **2347**

The Effect of Semiconducting Liquids on the Dielectric Properties of Cellulose Insulation.—Clark. (*See* 2458.)

621.392.52.015.33 **2348**

Transient Response of Filters.—E. T. Emms. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 126–127.) Reply to the letters of Belevitch and Thomson (2035 of July) agreeing with their conclusions. See also 662 of March and back references.

621.394/.397].645 **2349**

Cathode-Follower Circuit using Screen-Grid Valves.—E.M.I. Laboratories. (*Electronic Engng*, March 1947, Vol. 19, No. 229, p. 97.) A description of a circuit arrangement using a screen-grid valve as a cathode-follower repeater, with reduced loss of signal transfer.

621.395.623 : 578.088.7 **2350**

A Simplified Encephalophone.—M. Conrad & B. L. Pacella. (*Science*, 21st Feb. 1947, Vol. 105, No. 2721, p. 216.) A simplified adaptor which converts the varying l.f. voltages observed with an electro-encephalograph into variations in the pitch of an audible tone.

621.396.61 : 517.512.2 **2351**

Fourier Transform Analysis.—M. M. Levy. (*J. Brit. Instn Radio Engrs*, Dec. 1946, Vol. 6, No. 6, pp. 228–246.) A study of the properties of Fourier transforms with examples of applications to a wide variety of radio problems. A new notation is used. See also 3651 of 1946.

621.396.611.21 **2352**

On the Resonant Frequencies of n-Meshed Tuned Circuits.—P. Parzen. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 284–285.) The fact that multiplication of all the inductances (self and mutual) and capacitances by factors of A^2 and B^2 respectively divides the resonant frequency by AB is proved for n-meshed coupled tuned circuits and applied to the predimensioning of quartz oscillating crystals.

621.396.611.3 **2353**

RC Coupling.—(*Wireless World*, April 1947, Vol. 53, No. 4, p. 131.) Data for the design of couplings for pulse and saw-tooth waves.

621.396.611.4 **2354**

Natural Frequencies of E-Type of a Capacitance-Loaded Cylindrical Resonator.—F. Lüdi. (*Helv. phys. Acta*, 2nd Nov. 1944, Vol. 17, No. 6, pp. 429–436. In German.)

621.396.615 **2355**

Phase-Shift Oscillators.—P. G. M. Dawe & A. S. Gladwin. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 125–126.) The resistance-reactance network associated with a phase-shift oscillator is usually considered to form an aperiodically damped system, so that no oscillatory current can occur. It is pointed out that the response of such a circuit to a transient input involves voltage reversals, having the character of a heavily damped oscillation.

621.396.615 **2356**

Three-Phase RC Oscillator for Radio and Audio

Frequencies.—H. Rakshit & K. K. Bhattacharyya. (*Indian J. Phys.*, Oct. 1946, Vol. 20, No. 5, pp. 171–186.) Regenerative feedback from the output to the input of a 3-stage amplifier enables either audio or radio frequencies to be generated, depending on circuit arrangements. Theory is confirmed by experiment. See also 1796 of 1946.

621.396.615 : 621.396.619.16 **2357**

Pulse Modulated Oscillator.—A. Easton. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 124–129.) A pulsed resonant circuit giving a damped wave train is combined with a keyed oscillator that builds up oscillations, thus obtaining a pulsed oscillator generating a wave train of constant amplitude.

621.396.615.029.5 **2358**

H.F. Beat-Frequency Oscillator.—R. Aschen & M. Lafargue. (*T.S.F. pour Tous*, March 1947, Vol. 23, No. 221, pp. 52–54.) Part 1 of another account of 1709 of June.

621.396.615.029.6 : 621.397.62 **2359**

The 6C5 and 54 Mc/s.—H. Pinot. (*Télévis. franç.*, Feb. 1947, No. 22, p. 19.) Details of an oscillator suitable for testing the sound channel in television receivers.

621.396.615.14.012.2 **2360**

***Q* Circles — A Means of Analysis of Resonant Microwave Systems : Part 1.**—W. Altar. (*Proc. Inst. Radio Engrs, W. & E.*, April 1947, Vol. 35, No. 4, pp. 355–361.) A new circle diagram is given for magnetrons and similar resonant systems with an isolated single resonant mode. The diagram is drawn in terms of complex reflection coefficients, the values of which are obtained by standing-wave measurements in the outgoing line. A theoretical discussion will be given later.

621.396.615.17 : 621.316.729 **2361**

On the Synchronization of Valve Generators.—H. Samulon. (*Helv. phys. Acta*, 5th Aug. 1941, Vol. 14, No. 4, pp. 281–306. In German.) A discussion of synchronization by an external a.c. potential, particularly for the case where the applied potential has a frequency close to a harmonic of the fundamental frequency of the generator. A solution is given of the phase-balance equation for the back-coupled generator with tuned anode circuit. A reference was given in 3322 of 1943.

621.396.615.17 : 621.317.733 **2362**

On a Bridge Circuit for Relaxation Oscillations.—H. Zickendraht. (*Helv. phys. Acta*, 12th July 1944, Vol. 17, No. 4, pp. 234–235. In German.) A bridge using two resistances and two thyratrons gives powerful oscillations whose waveform may be adjusted to provide a ' saw-tooth ' timebase.

621.396.616 : 621.396.662.2.076.2 **2363**

Precision Master Oscillators.—T. A. Hunter. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 71–73 . . 126.) Permeability-tuned and sealed units of stability equivalent to that of a crystal-controlled oscillator.

621.396.621 : 621.396.619.11 **2364**

The " Synchrodyne " : A New Type of Radio Receiver for A.M. Signals.—D. G. Tucker. (*Electronic Engng*, March 1947, Vol. 19, No. 229, pp. 75–76.) A description of a process of demodulation whereby the incoming signal is modulated with a frequency equal to its own carrier frequency. The modulation-frequency output of the wanted signa is then obtained correctly and all other signals become high frequencies relative to the modulation frequency and can be separated by means of a low-pass filter in the output circuit.

621.396.621 : 621.396.619.13 **2365**

Designing an F.M. Receiver : Part 1.—T. Roddam. (*Wireless World*, April 1947, Vol. 53, No. 4, pp. 143–145.) Discusses principles of design of the mixer and i.f. stages.

621.396.622.71 : 621.396.813 **2366**

Distortion in Diode Detectors.—R. A. Lampitt. (*Electronic Engng*, March 1947, Vol. 19, No. 229, pp. 94–96.) The cause of the distortion introduced by the use of an a.f. amplifier immediately following a diode detector is discussed and two remedies are outlined.

621.396.645 : 518.4 **2367**

Graphical Analysis of Cathode-Biased Degenerative Amplifiers.—W. A. Huber. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 265–269.) A method by which it is possible to predict the performance of cathode-follower and anode-resistance-loaded, cathode-degenerative triode amplifiers.

621.396.645 : 621.396.621.029.6 **2368**

I.F. Amplifier for High Gain F.M. Receiver.—D. W. Martin. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 60–62.) High sensitivity and selectivity in a v.h.f. communications receiver is obtained with a new circuit.

621.396.645.029.3 **2369**

A.C.-D.C. Audio Amplifier.—G. Eannarino. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 40–41.) Full circuit details of a four-valve audio amplifier giving 8 W output with 10% distortion over the range 40–15 000 c/s. No transformers are used iu an a.c./d.c. selenium-rectifier power supply.

621.396.645 **2370**

Balanced Amplifiers.—F. F. Offner. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 306–310.) The addition of in-phase feedback to push-pull impedance-coupled amplifiers gives definite advantages. Circuits are given for various applications of such amplifiers.

621.396.645.36.078 **2371**

Automatic Gain Adjusting Amplifier.—D. E. Maxwell. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 34–36, 128.) A push-pull amplifier. The controlled variable negative feedback is preceded by a signal-frequency delay network, so that the controlling bias, derived from the input to the network, is applied before transient peaks can overload the amplifier.

621.396.662.21.042.1 **2372**

Those Iron-Cored Coils again.—P. K. McElroy. (*Gen. Radio Exp.*, Dec. 1946 & Jan. 1947, Vol. 21, Nos. 7 & 8, pp. 2–8 & 2–8.) The application of the theory developed previously (*ibid.*, March 1942, P. K. McElroy & R. F. Field) is simplified. Part 1 gives an empirical method for determining the maximum storage factor Q of a coil wound on a particular lamination structure, the frequency at which it occurs and the law of variation of inductance with the width of the centre-leg air gap.

Part 2 gives a method for obtaining the effective permeability of a core of ferromagnetic material with centre-leg air gap, taking account of the fringing that occurs at the air gap. Examples of the use of the methods are given.

621.396.662.3 : 537.228.1 **2373**
Piezoelectric Quartz.—A. V. J. Martin. (*Toute la Radio*, March/April 1947, Vol. 14, No. 114, pp. 107–111.) Various types of crystal filters, using one, two or four crystals are described and their properties compared. Recent developments briefly mentioned include a quartz transformer, using two crystals slices of identical frequency and giving a variable selectivity, with a very high Q. The pass band of such an arrangement can readily be varied from 10 c/s up to 1 000 c/s.

621.396.667 **2374**
Towards High Fidelity. Expansion Circuits.—Tabard. (*See* 2565.)

621.396.69+621.317.7+621.38 **2375**
Physical Society Exhibition.—(*See* 2494.)

621.396.69+621.317.7 **2376**
The R.C.M.F. [Radio Component Manufacturers' Federation] **Exhibition.**—(*Electronic Engng*, April 1947, Vol. 19, No. 230, pp. 131–132.) A review of some of the test instruments and radio components shown at the 1947 Exhibition. See also 2055 of July.

621.396.69 **2377**
The 1947 National Salon of Radio Components and Accessories.—G. Giniaux. (*TSF pour Tous*, March–May 1947, Vol. 23, Nos. 221–223, pp. 49–51, 83–90 & 111–112.) A review of some of the novelties exhibited, including coils, fixed and variable capacitors, tuning units, switches, microphones, loudspeakers, meters, etc.

621.396.69 **2378**
After the [Paris] **Components Exhibition.**—" A Visitor". (*Radio en France*, 1947, No. 3, pp. 4–7.) A review of some of the novelties at the exhibition.

621.396.692.011.2.012.3 **2379**
Resistances in Parallel.—G. S. Lowey. (*Elect. Times*, 6th Feb. 1947, Vol. 111, No. 2885, p. 165.) A simple graphical method of determining the resultant of any number of resistances in parallel.

621.396.694.012.8 **2380**
Circuit Conventions. The Valve " Equivalent Generator ".—" Cathode Ray ". (*Wireless World*, April 1947, Vol. 53, No. 4, pp. 129–130.) An attempt to remove the confusion apparent in the valve ' equivalent generator ' principle regarding directions of the voltages and currents.

621.397.62.018.078.3 **2381**
Automatic Frequency-Phase Control in TV Receivers.—Wright. (*See* 2599.)

621.392.52 **2382**
Electric Filters. [Book Review]—T. H. Turney. Pitman & Sons, London, 170 pp., 25s. (*Elect. Rev., Lond.*, 28th March 1947, Vol. 140, No. 3618, p. 480.)

GENERAL PHYSICS

53.081 **2383**
On Unities [units] **and Dimensions : Part 3.**—H. B. Dorgelo & J. A. Schouten. (*Proc. Acad. Sci. Amst.*, April 1946, Vol. 49, No. 4, pp. 393–403. In English.) Conclusion of 1392 of May. Preference expressed for the rationalized system of Giorgi with m, l, t and q.

530.145 **2384**
Quantum Theory of Electromagnetic Fields : Part 1.—P. Suquet. (*Télévis. franç.*, Feb. 1947, No. 22, Supplement *Électronique*, pp. 1–3.) Preliminary mathematics and general principles.

530.145.6 **2385**
On the Polarization of Electron Waves.—A. Sokolow. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 363–372.) The polarization is investigated for reflection from a potential barrier and for scattering by a force centre possessing electrical charge and magnetic moment. The scattering is treated by means of Dirac's perturbation theory.

534.1 : 621.392.029.64 **2386**
The Interaction of Oscillating Systems with Distributed Parameters.—P. Krasnooshkin. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 439–446.) A theoretical treatment of the waves travelling in a set of one-dimensional systems such as parallel strings with force and inertia couplings. Application is made to waveguides and to parallel Lecher systems coupled by inductance coils distributed along their length.

535.13+538.3 **2387**
An Extension of Fresnel's Formulae.—R. Mercier. (*Helv. phys. Acta*, 24th Oct. 1942, Vol. 15, No. 6, pp. 515–518. In French.) The electric intensities of the waves reflected and transmitted by a plane boundary between two media are related to the ratios of the refractive indices and of the wave resistances. The effect of difference of permeability is discussed.

535.13 **2388**
Quasi-Optical Links : Models of Ellipsoids [of diffraction] **and Spatial Aerials with Experimental Results.**—Dreyfus-Graf. (*See* 2545.)

535.312.2 **2389**
Optical Theory of the Corner Reflector.—R. C. Spencer. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 134.) Summary of Amer. Phys. Soc. paper. Experimental results with a corner made from three glass mirrors are presented graphically and discussed. The analysis of the effect of errors of perpendicularity of adjacent sides, as treated by G. A. Van Lear, Jr, is extended and applied to both triangular and square corners.

2390
535.343+621.396.11.029.64] : [546.212+546.212.02
Interpretation of the Microwave Absorption of HDO at 1.3 Centimeters.—G. W. King & R. M. Hainer. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 135.) Summary of Amer. Phys. Soc. paper.

537.291 **2391**
Energy Distribution and Stability of Electrons in Electric Fields.—H. Fröhlich. (*Proc. roy. Soc. A*, 25th Feb. 1947, Vol. 188, No. 1015, pp. 532–541.) On the usual assumption that electrons are scattered

by the lattice vibrations only, a stationary state cannot be reached. Stationary conditions can probably be obtained by considering also collisions between electrons. For very small electron density, electron collisions are negligible. In this case the possibility of reaching stationary conditions depends on the behaviour of electrons whose energy is large enough to ionize, or excite ions of, the lattice.

537.291 : 621.396.615.141.2 **2392**

Electron Trajectories in a Plane Single-Anode Magnetron — A General Result.—Brillouin. (*See* 2632.)

537.311.2 **2393**

What is Ohm's Law?—"First-Year Lecturer": C. Turnbull. (*Elect. Rev., Lond.*, 7th March 1947, Vol. 140, Nos. 3613/3615, pp. 349-350.) Comment on 1063 of April.

537·5 **2394**

A Proposed Detector for High Energy Electrons and Mesons.—I. A. Getting. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, pp. 123–124.) Depends on the emission of visual radiation by a charged particle moving at constant speed in a medium where the phase velocity of the light is smaller than the velocity of the particle.

The visual radiation produced in a cone of Lucite or Plexiglass, along the axis of which the electrons or mesons are incident, is detected by focusing on to a photo-multiplier to which is connected a video amplifier.

537·523·5 **2395**

On the Current Density in the Initial Stages of an Arc.—R. Holm. (*Ark. Mat. Astr. Fys.*, 7th March 1947, Vol. 34, Part 1, Section B, No. 8, 7 pp. In German.) Current densities of the order of 10^4 A/cm^2 may occur within times of the order of 10^{-4} sec, with much greater densities immediately after striking.

537·523·5 **2396**

On the Mechanism of Arc Discharge.—O. P. Semenova. (*C. R. Acad. Sci. U.R.S.S.*, 30th March 1946, Vol. 51, No. 9, pp. 683–686. In English.) The effective ionization potential is determined not by the principal component of the arc gas, as is usually assumed, but by the component having the lowest ionization potential, even though present in a comparatively small quantity. Experimental confirmation of this is described.

537·525 : 621.385.18 **2397**

Effect of Direct-Current Potential on Initiation of Radiofrequency Discharge.—A. A. Varela. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, pp. 124–125.) An explanation of the failure to improve the speed of initiation of the discharge in a gaseous discharge switch for radar duplexing by the application of a d.c. potential less than that required to initiate the discharge.

537·525·3 **2398**

The Development of Discharge Paths of an Impulse Corona.—V. Hey & S. Zayentz. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 413–418.)

537·525·3 **2399**

The Investigation of the Impulse Corona in a Cloud Chamber.—V. Hey & S. Zayentz. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 405–412.)

537·525·5 + 621.396.822] : 621.385 **2400**

Effects of Magnetic Field on Oscillations and Noise in Hot-Cathode Arcs.—J. D. Cobine & C. J. Gallagher. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 110–116.) Application of a transverse magnetic field is shown to produce two new effects, suppression of the oscillations and radical alteration of the noise spectrum. See also 3266 and 3267 of 1946.

537·525·5 + 621.396.822] : 621.385 **2401**

Noise in Gas Tubes.—J. D. Cobine & C. J. Gallagher. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 144 . . 198.) Noise characteristics are tabulated for a number of hot-cathode discharge tubes and are compared with the shot noise of a diode for two different currents and a 3 000-Ω load resistance. The shape of the noise spectrum is determined by the valve geometry. See also 3266 and 3267 of 1946, 1406 of May, and 2400 above.

537·531 **2402**

Radiation of a Uniformly Moving Electron due to Its Transition from One Medium into Another.—I. Frank & V. Ginsburg. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 353–362.) "The intensity, polarization and angular distribution of the radiation are calculated as functions of the dielectric constants and conductivities of the two media."

537·533·8 **2403**

The Velocity Distribution of Secondary Electrons for Various Emitters.—A. Kadyshevich. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 431–435.) Investigates the dependence on the velocity of the primary electrons and on the energy parameters of the emitter.

537·533·8 **2404**

On the Measurement of the Depth of Generation of the Secondary Electrons in Metals.—A. Kadyshevich. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 436–438.)

537·539 + 621.315.61.015.5 **2405**

On the Theory of Dielectric Breakdown in Solids.—H. Fröhlich. (*Proc. roy. Soc. A*, 25th Feb. 1947, Vol. 188, No. 1015, pp. 521–532.) The theory previously developed is found to be correct only below a critical temperture T_e, above which the density of electrons (in strong fields) is so high that mutual collisions between electrons are more frequent than collisions between electrons and the lattice vibrations. In strong external fields this leads to an equilibrium distribution of the electrons at an electronic temperature T which is higher than the lattice temperature. Equilibrium can only be obtained if the field is below a critical value F^*. For stronger fields the electronic temperature T rises steadily until the crystal breaks down. F^* decreases exponentially with increasing lattice temperature. The theory now accounts for the rise of dielectric strength with temperature at low temperatures and for its decrease at high temperatures. It also shows why influences which tend to increase the dielectric strength at low temperatures (e.g., admixture of foreign atoms) tend to decrease it in the high-temperature region. The increase of electronic temperature with the field strength F leads, for $F<F^*$, to an increase of electronic conductivity with F which is calculated quantitatively. See also 1787 of 1943 and 2979 of 1944.

537.56 : 538.6 **2406**

Production of H.F. Energy by an Ionized Gas in the Presence of a Magnetic Field.—J. Denisse & J. L. Steinberg. (*C. R. Acad. Sci., Paris,* 3rd March 1947, Vol. 224, No. 9, pp. 646–648.) The tubes used contained pure nitrogen at various pressures ; in some cases they had tungsten filament cathodes and in others aluminium electrodes. A detailed account is given of the effects of magnetic fields of various strengths applied at different points along the tubes.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.82 **2407**

Whistling Meteors. Audible Radio Reflections from Shooting Stars.—G. R. M. Garratt. (*Wireless World,* April 1947, Vol. 53, No. 4, pp. 141–142.) Chamanlal and Venkataraman have found at Delhi (1607 of 1942) that under favourable conditions meteors give faint heterodyne whistles in a communication receiver. These are attributed to a Döppler effect due to interference of the direct ground waves from the transmitter with the waves reflected from the local area of ionization caused by the passage of the meteor through the atmosphere. The effect is discussed and optimum conditions for its observation are given. See also 916 of 1946.

523.53 "1946.10.09" : 551.510.535 **2408**

Ionization by Meteoric Bombardment.—J. A. Pierce. (*Phys. Rev.,* 15th Jan. 1947, Vol. 71, No. 2, pp. 88–92.) The meteor shower of October 9–10, 1946, produced intense ionization in the upper atmosphere, from which the energy required to produce an ionospheric layer can be calculated. The necessary power is found to be a few watts per square kilometre, a value comfortably exceeded by the black body radiation of the sun in the region of 1 000 Å.

523.75 **2409**

The Structure of the Solar Atmosphere.—M. Waldmeier. (*Helv. phys. Acta,* 8th July 1942, Vol. 15, No. 4, pp. 405–422. In German.) A theoretical discussion of the stratification of an atmosphere in radiation equilibrium, with application to the photosphere, sun-spots, the Evershed effect, and the diminution of brightness near the edge of the disk.

523.752 : [551.510.535 + 621.396.812 **2410**

Eruptions of the Solar Chromosphere and Their Influence on the Ionosphere and on Wave Propagation. Their Effects in Different Regions of the Radio Spectrum.—Bureau. (*See* 2550.)

523.78 "1945.07.09" : 621.396.812 : 551.510.535 **2411**

Results obtained in observing the Propagation of Radio Waves during the Solar Eclipse of 9th July 1945.—A. A. Grigor'eva. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1946, Vol. 10, No. 3, pp. 253–260. In Russian.) Observations were made at the ionosphere stations near Moscow and Leningrad and short-wave transmissions from Leningrad, Moscow and Kuibisheff (at frequencies of the order of 7 Mc/s) were observed at 22 points in the eclipse zone.

The following main results were obtained. (*a*) During the optical eclipse the critical frequency of the F_2 layer decreased by 14% at Moscow and by 20% at Leningrad. (*b*) The variation of the height of the maximum ionization level remained within the accuracy limits of height measurements. (*c*) At certain periods during the optical eclipse increases of 100% in the field intensity were observed. (*d*) Increases in the audibility, mainly coinciding with field intensity increases, were observed during the optical eclipse. (*e*) In one case a considerable increase in the ionization was observed in Leningrad associated with decreases of the field intensity and audibility at a number of control points. (*f*) Variations of the audibility were observed in the zone of possible influence of the corpuscular eclipse. No corresponding variations were observed outside this zone.

523.78 "1945.07.09" : 621.396.812 : 551.510.535 **2412**

On the Results of the Ionosphere Measurements made during the Solar Eclipse of 9th July 1945.—N. D. Bulatoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1946, Vol. 10, No. 3, pp. 269–274. In Russian.) Observations of the ionosphere were made at stations near Leningrad and Moscow and the field intensities of radio transmitters operating at Leningrad and Moscow (at frequencies from 1.75 to 5.0 Mc/s) were measured at various points.

The following conclusions were reached : (*a*) The decrease in the ionization of the E, F_2 and lower absorbing layers during the passing of the optical shadow of the sun confirms that the main factor in the ionization of all layers is the ultra-violet radiation from the sun. Similar confirmation for the lower layers is given by the sharp increase in the field intensity of radio stations during totality and a corresponding decrease towards the end of the eclipse. (*b*) The absence of the expected effects of the corpuscular eclipse indicates that although the existence of the corpuscular stream under normal conditions is possible, the intensity of the stream is too low to produce observable changes in the ionization. It should be noted that corpuscular eclipses are calculated neglecting the effects of the magnetic field of the earth.

537.591 **2413**

Absorption of Cosmic Radiation at 2 100 m.—G. Salvini. (*Nuovo Cim.,* 1st Aug. 1946, Vol. 3, No. 4, pp. 283–284.)

537.591 **2414**

The Intensity Fluctuations in the Hard Component of Cosmic Radiation on the Jungfraujoch (3 500 m above sea level).—H. Wäffler. (*Helv. phys. Acta,* 5th Aug. 1941, Vol. 14, No. 4, pp. 215–256. In German.)

537.591 **2415**

An Example of Meson Production in Lead.—G. D. Rochester, C. C. Butler & S. K. Runcorn. (*Nature, Lond.,* 15th Feb. 1947, Vol. 159, No. 4033, pp. 227–228.) The two cloud-chamber photographs reproduced suggest that one of the particles emerging from the lead plate is a slow meson.

537.591.15 **2416**

The Extension of the Shower Theory to Low Energy [levels].—N. Dallaporta & E. Clementel. (*Nuovo Cim.,* 1st Aug. 1946, Vol. 3, No. 4, pp. 235–251. In Italian, with English summary.) Results obtained by an approximation method confirm the great penetration of photons into lead for energies of about 3×10^6 eV.

537.591.15 **2417**

Auger Showers.—M. M. Mills & R. F. Christy. (*Phys. Rev.*, 15th Feb. 1947, Vol. 71, No. 4, p. 275.) Summary of Amer. Phys. Soc. paper. Examination of Lewis's data on coincident bursts (2889 of 1945; see also 2890 of 1945) shows that if ionization due to electrons is to afford an explanation, "it will probably require initiating electrons of energy $>10^{14}$ eV produced predominantly near the top of the atmosphere and with several electrons having considerable angular spread associated in one event." An alternative possibility that the bursts are due to nuclear disintegrations is being examined.

537.591.5 **2418**

Production of Mesotrons up to 30 000 Feet at a Magnetic Latitude of 22° North.—P. S. Gill. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, pp. 82–84.) Discovery of a marked hump in the intensity/altitude curve at a pressure of 530 mb.

551.510.535 **2419**

On the Work of the Ionosphere Bureau of the Institute of Terrestrial Magnetism.—J. V. Leshchinsky & N. V. Pushkov. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 3, pp. 279–280. In Russian.)

551.510.535 **2420**

Electronic Collisional Frequency in the Upper Atmosphere.—E. F. George. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 249–252.) Tables are given showing the collisional frequency as a function of height for night and day conditions, which are thought to represent maximum and minimum values.

551.510.535 : 525.6 **2421**

Atmospheric Tides in the Ionosphere : Part 1—Solar Tides in the F_2 Region.—D. F. Martyn. (*Proc. roy. Soc. A*, 17th April 1947, Vol. 189, No. 1017, pp. 241–260.) Horizontal winds due to solar tides and the earth's magnetic field cause a vertical component in the velocities of free ions. It is assumed that the velocities decrease with increase of height in the F_2 region. The theory shows that for downward velocities a Chapman region is modified so that the maximum ionization density is reduced, but its height may be above or below the Chapman height, depending on the velocity gradient. Upward velocities lead to increased ionization densities at heights generally above the Chapman height. These results are applied to account for the observed anomalous behaviour of the F_2 region, including the semi-diurnal period, for the existence of which observational evidence is given.

551.510.535 : 535.211 **2422**

Radiative Equilibrium in the Ionosphere.—R. v. d. R. Woolley. (*Proc. roy. Soc. A*, 17th April 1947, Vol. 189, No. 1017, pp. 218–240.) Molecular and atomic oxygen are the principal ultraviolet absorption agents at heights below and above 250 km respectively. Water vapour is the principal infra-red radiator at 100 km, but at 250 km the temperature is controlled by negative ions. At much greater heights the temperature is perhaps controlled by dust particles.

551.510.535 : 621.396.11.029.45 **2423**

The Oblique Reflexion of Very Long Wireless Waves from the Ionosphere.—Wilkes. (*See* 2548.)

551.593.9 : 535.243 **2424**

Spectrophotometer Measurements of the Spectrum of the Night Sky (λλ 4 600–3 100).—D. Barbier. (*C. R. Acad. Sci., Paris*, 3rd March 1947, Vol. 224, No. 9, pp. 635–636.) Spectra for wavelengths 3 100–4 600 Å have been obtained at the Haute-Provence observatory at zenith distances of 10° and 80°. Comparison of the spectra taken at the two distances enables the altitude of emission of the bands to be determined. Discussion of the results shows that an appreciable part of the continuous background light comes from the atmosphere. The whole of the measured brightness of the night sky can now be apportioned approximately between spectral rays, bands, zodiacal light extension, and the light of faint stars.

551.594.25 **2425**

The Electrical Charge on Precipitation at Various Altitudes and Its Relation to Thunderstorms.—R. Gunn. (*Phys. Rev.*, 1st Feb. 1947, Vol. 71, No. 3, pp. 181–186.) The free electrical charges on individual precipitation particles at various altitudes up to 2 600 ft were measured by an induction method. The results are shown graphically and discussed. Electric field measurements showed that the particle charges are largely neutralized by nearby charges. Removal of the neutralizing charge will immediately produce thunderstorm electric fields and potentials.

551.594.5 : 538.691 **2426**

Experiments on the Aurorae.—K. G. Malmfors. (*Ark. Mat. Astr. Fys.*, 7th March 1947, Vol. 34, Part 1, Section B, No. 1, 8 pp. In English.) An account of experiments to study the motion of charged particles in a magnetic dipole field under the influence of a homogeneous electric field. The results are discussed in relation to Alfvén's theory of magnetic storms and the aurora.

LOCATION AND AIDS TO NAVIGATION

534.88 **2427**

Submarine Detection by Sonar.—A. C. Keller. (*Bell Lab. Rec.*, Feb. 1947, Vol. 25, No. 2, pp. 55–60.)

621.396.11 **2428**

On the Coastal Effect in Radio Direction Finding.—E. L. Feinberg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 2, pp. 196–216. In Russian.) Previous investigations of the phenomenon are briefly reviewed; it is usual to ascribe the effect to the difference in the electrical properties of land and sea and to call it 'coastal refraction'. The author suggests that the actual vertical configuration of the coast also affects the propagation of electromagnetic waves, since it is known, for example, that the difference in the electrical constants of land and sea is greater in the case of a high coast. Accordingly a more general theory is developed in which the effect of the boundary line is taken into account and formulae are derived for different relative positions of the observer and transmitter. The considerable effect of the transitional zone is also demonstrated.

The theory is derived from a general theory of the propagation of radio waves along a non-uniform and uneven surface developed by the author elsewhere (1962 of 1946 and back references). That theory was based on an integral equation first solved by Grünberg (3386 of 1944) and more fully investigated by Fock in *Mathematicheski Sbornik*, 1–2 (1944). In the present paper a method is proposed which makes the solution of the integral equation unnecessary and the problem is reduced to the evaluation of integrals of known functions. This results in a considerable simplification of the necessary calculations.

In conclusion a brief analysis is made of available experimental data, which are in conformity with the theory.

621.396.11 : 621.396.93 **2429**

A New Source of Systematic Error in Radio Navigation Systems requiring the Measurement of the Relative Phases of the Propagated Waves.—K. A. Norton. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, p. 284.) Accurate navigational fixes can be obtained only when the effective values of ground constants along the propagation path are known accurately. Methods are outlined for correcting range errors due to phase variation.

621.396.7 : 621.396.96 **2430**

The Decca Navigator.—P. Giroud. (*Ann. Radioélect.*, Oct. 1946, Vol. 1, No. 6, pp. 409–433.) For other accounts see 1242 and 3606 of 1946.

621.396.93 : 621.396.677.1 **2431**

The Compensated-Loop Direction Finder.—F. E. Terman & J. M. Pettit. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, p. 269.) Corrections to 2659 of 1945.

621.396.932 + 621.396.96 **2432**

Radar on the Great Lakes.—N. A. Schorr. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 35–38.. 147.) A general account of navigational difficulties and recently developed navigation aids. The p.p.i. system is outlined, and essential features are given of six different types of radar installations now operating as test units aboard lake carriers. Research to determine the most efficient system is proceeding.

621.396.933 **2433**

Teleran.—P. Hémardinquer. (*Télévis. franç.*, March 1947, No. 23, pp. 18–19.) A short account of the principles of operation. For a more detailed account see 1546 of 1946.

621.396.933 **2434**

Safety in the Air.—J. A. McGillivray. (*Wireless World*, April 1947, Vol. 53, No. 4, pp. 146–149.) The adoption of a universal standard air navigation system is urged. The advantages and disadvantages of nine existing types of radio aids to navigation are discussed.

621.396.933.1 **2435**

LANAC Two-Signal Navigation System.—(*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 49–53, 129.) Basic principles of a laminar navigation and anti-collision system. Incorporates challenger and replier units ; a different altitude code is used for each 1 000-ft height layer. Position can be obtained with only one beacon. Operation is automatic.

621.396.933.23 : 389.6 **2436**

P.I.C.A.O. recommends C.A.A. Instrument Landing.—H. G. Shea. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 40–43..124.) Condensed specifications for aircraft loran, radar, beacons and landing aids by the Provisional International Civil Aviation Organization. For another account, by D. H. Pain, see *Electronics*, Feb. 1947, Vol. 20, No. 2, pp. 80–83.

621.396.96 : 531.55 **2437**

Navy Fire-Control Radars.—W. M. Kellogg. (*Bell Lab. Rec.*, Feb. 1947, Vol. 25, No. 2, pp. 64–69.) A description of the Mark 3 and Mark 4 radar systems employed largely in the U.S. Navy during the earlier stages of the war. Operation was in the 680–720 Mc/s frequency range, with a pulse power of about 40 kW. Aerials were horizontal cylindrical parabolas fed by a row of dipoles; a gas-switch enabled the same aerial and feeder to be used for transmission and reception. See also 1798–1804 of June.

621.396.96 : 551.594.6 **2438**

Storm Indication by Radio Locators.—V. A. Vvedenski. (*Radio, Moscow*, April 1946, No. 1, pp. 4–8. In Russian.)

621.396.96: 621.396.621 **2439**

Considerations in the Design of Centimeter-Wave Radar Receivers.—Miller. (*See* 2562.)

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **2440**

New Developments in Vacuum Engineering.—R. B. Jacobs & H. F. Zuhr. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 34–48.) Methods are described for obtaining vacuum tightness in the K-25 gaseous diffusion plant for the separation of U^{235}. New techniques include the helium hood method for leak detection with the mass spectrometer (2441 below) and the use of calibrated leaks.

533.5 : 539.163.2.08 **2441**

Mass Spectrometer for Leak Detection.—A. O. Nier, C. M. Stevens, A. Hustrulid & T. A. Abbott. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 30–33.) A simple low-resolution instrument using helium for leak detection in high vacuum equipment. One part of helium in 200 000 parts of air gives a definite indication on the output meter.

534.133 + 621.396.611.21.016.2 **2442**

High Intensity Ultrasonics: The Power Output of a Piezoelectric Quartz Crystal.—L. F. Epstein, W. M. A. Andersen & L. R. Harden. (*J. acoust. Soc. Amer.*, Jan. 1947, Vol. 19, No. 1, pp. 248–253.) The maximum ultrasonic power density experimentally attained up to the present with a quartz crystal is considerably less than that predicted from the characteristics of quartz. Failure is attributed to dielectric breakdown in the surrounding fluid; if the breakdown voltage gradient of the medium is independent of thickness the maximum power density is independent of frequency, but if the gradient decreases with thickness, the maximum power density increases with frequency. An output of 43 W/cm^2 has been achieved at 1 000 kc/s.

535.37 **2443**

Decay of Phosphorescence in Cu-Activated ZnS.—H. M. James. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 137.) Summary of Amer. Phys. Soc. paper.

535.376 : 537.226.2 **2444**

Electron Traps and Dielectric Changes in Phosphorescent Solids.—G. F. J. Garlick & A. F. Gibson. (*Proc. roy. Soc. A*, 25th Feb. 1947, Vol. 188, No. 1015, pp. 485–509.)

537.228.1 **2445**

Piezoelectric Substances.—M. Bruzau. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 445–459.) A comprehensive review originally published in French with the title 'Les Substances Piézoélectriques Synthétiques' in 1940, and including a large bibliography. Static and dynamic tests for the detection of piezoelectricity are described and all the known substances are classified in 8 tables according to their crystalline structure. Artificial crystals are discussed, with particular reference to the properties of Rochelle salt. The various measurements that have been made on the abnormal variations of its dielectric constant and piezoelectric moduli with temperature are reviewed and the different crystal cuts are described. Other artificial crystals, and the possibility of orienting small crystals to give large piezoelectric slabs, are discussed.

537.228.1 **2446**

The Elastic Behaviour of Rochelle-Type Substances.—W. Bantle & W. Lüdy. (*Helv. phys. Acta*, 8th July 1942, Vol. 15, No. 4, pp. 325–327. In German.)

537.228.1 **2447**

The Influence of Temperature on the Dynamic-Elastic Behaviour of Rochelle-Type Substances.—W. Lüdy. (*Helv. phys. Acta*, 24th Oct. 1942, Vol. 15, No. 6, pp. 527–552. In German.)

537.228.1 **2448**

The Specific Heat of Rochelle-Type Substances. Dielectric Measurements on KD_2PO_4 Crystals.—W. Bantle. (*Helv. phys. Acta*, 8th July 1942, Vol. 15, No. 4, pp. 373–404. In German.)

537.228.1 **2449**

The Inverse Piezoelectric Effect of Rochelle-Type KH_2PO_4 Crystals.—A. von Arx & W. Bantle. (*Helv. phys. Acta*, 12th July 1944, Vol. 17, No. 4, pp. 298–318. In German.) Full paper; summary abstracted in 3643 of 1945.

537.228.1 **2450**

Electro-Optical Properties of the Rochelle-Type Crystals KH_2PO_4 and KD_2PO_4.—B. Zwicker & P. Scherrer. (*Helv. phys. Acta*, 6th Sept. 1944, Vol. 17, No. 5, pp. 346–373. In German.) Experimental investigation with theoretical discussion of double refraction, the spontaneous Kerr effect, the linear electro-optical effect at $T > \theta$, where θ is the Curie temperature, electro-optical hysteresis at $T < \theta$, dielectric constant, anomaly of the specific heat and 'freezing' of polarization.

537.228.1 **2451**

Dielectric Measurements on KH_2PO_4 and KH_2AsO_4 at Low Temperatures.—G. Busch & E. Ganz. (*Helv. phys. Acta*, 15th Aug. 1942, Vol. 15, No. 5, pp. 501–508. In German.) The Curie temperature is 123.5°K for KH_2PO_4 and 96.5° K for KH_2AsO_4. Between about 75° and 50° K the dielectric constants fall to very low values and the dielectric loss reaches a maximum of 3 joules/cm³.

537.311.33 + 621.315.59] : [546.28 + 546.289 **2452**

Measurements of Hall Effect and Resistivity of Germanium and Silicon from 10° to 600° K.—G. L. Pearson & W. Shockley. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 142.) Summary of Amer. Phys. Soc. paper. For *p*-type germanium the logarithm of the Hall coefficient is linear in 1/T°K below 90°K, giving an activation energy of 0.007 eV. For the *n*-type a similar linear relation is found between 17° and 90°K, the activation energy being about the same. "Silicon containing 0.03 atomic per cent boron, has essentially constant resistivity and Hall coefficient below 100°K." These results are discussed. See also 2216 of 1946.

537.311.33 : 537.58 **2453**

Thermal Ionization of Impurity Levels in Semi-Conductors.—B. Goodman, A. W. Lawson & L. I. Schiff. (*Phys. Rev.*, 1st Feb. 1947, Vol. 71, No. 3, pp. 191–194.) The ionization probabilities calculated by the use of a simple Debye model and an Einstein model may play an important part in determining the frequency dependence of the rectification efficiency of crystal rectifiers.

538.221 **2454**

Magnetic Spectra of Diverse Materials at Various Frequencies.—V. Arkadiev. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 5, pp. 373–378.)

549.514.51 : 534.133] + 621.396.611.21.012.8 **2455**

Calculation of the Equivalent Constants of a Quartz Plate in Plane Shear Vibration (Type CT, DT).—Dumesnil. (*See* 2341.)

621.314.632 + 537.311.33 **2456**

Photo- and Thermo-Effects in *p*-Type Germanium Rectifiers.—R. Bray & K. Lark-Horovitz. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, pp. 141–142.) Summary of Amer. Phys. Soc. paper. Photoconductive effects, depending on the particular germanium sample and the metal, leave the forward resistance relatively unchanged, but may so greatly reduce the back resistance as apparently to reverse the rectification. Photo-voltaic effects are observed usually in the back direction. Photo-effects approach maximum sensitivity in the near infrared (about 1.3 μ).

621.314.632 : 546.289 **2457**

Ge-Ge Contacts.—S. Benzer. (*Phys. Rev.*, 15th Jan. 1947, Vol. 71, No. 2, p. 141.) Summary of Amer. Phys. Soc. paper. Germanium crystals of various impurity content in contact with each other produce a rectification series (3628 of 1946—Brattain). Instead of the expected linear current/voltage characteristic, the characteristic observed for both polarities is of the order of the back resistance when either piece of the crystal is used with a metal. In both directions the negative resistance at high voltages appears. These effects are discussed.

621.315.59 : 621.315.616.92 : 621.319.4 **2458**

The Effect of Semiconducting Liquids on the Dielectric Properties of Cellulose Insulation.—F. M. Clark. (*Gen. elect. Rev.*, Feb. 1947, Vol. 50, No. 2, pp. 9–17.) The abnormalities met with when cellulose insulation is impregnated with high-loss liquids have been used in the development of a new type of capacitor having a high ratio of capacitance to volume. Such capacitors may be used at voltages above those at which electrolytic capacitors can be used continuously with safety, and below those at which the usual paper-spaced oil- or askarel-treated capacitors can be used with economy.

621.315.61 : 546.431.823 : 537.228.1 **2459**

Effect of Temperature on the Permittivity of Barium Titanate.—J. H. van Santen & G. H. Jonker. (*Nature, Lond.*, 8th March 1947, Vol 159, No. 4036, pp. 333–334.) Investigation shows that for TiO$_2$ (rutile), BaTiO$_3$ and titanates with various proportions of Ba and Sr, the permittivity ϵ in the cubic region is accurately represented by the formula $1/\epsilon = \beta(T-C)$, where β is a constant for each material and C is a temperature only slightly different from that corresponding to the maximum value of ϵ. It is concluded that in the temperature region of cubic structures there is no permanent dipole moment.

621.315.612 **2460**

Low Loss Ceramic Dielectric.—H. Thurnauer. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 86–87, 130.) A new material, which has been named AlSiMag 243, can be processed by standard steatite methods. The permittivity is 6.1 and the power factor 3×10^{-4} at 100 Mc/s.

621.318.23 **2461**

Permanent Magnet Design.—D. Hadfield. (*Elect. Times*, 20th & 27th March & 3rd April 1947, Vol. 111, Nos. 2889–2891, pp. 290–294, 323–325 & 357–359.) No rigid formulae for the design of permanent magnets for electrical instruments can be given, since operating conditions, leakage flux, etc., differ very much from one instrument to another. The properties of the various magnetic materials now available are shown graphically and tabulated. The relationship between magnet shape and operating point on the magnetization curve is considered for ring-shaped magnets. Maximum gap flux density for a given volume of magnet material is obtained when the magnet is operating at the $(BH)_{max}$ point of the material of which it is made. General principles are applied to the case of a ring-shaped magnet with soft pole pieces fitted between the ground faces of the gap. Composite magnets, with a block of one of the newer permanent magnet alloys and mild steel side limbs are briefly discussed, and also the question of increasing the sensitivity of an instrument by a new magnet without modification of the movement and other parts. Stabilization is also considered. See also 3371 of 1945.

621.357.6 **2462**

Electroforming. Piece Part Production by Electrodeposition.—E. A. Ollard. (*Metal Ind., Lond.*, 14th Feb. 1947, Vol. 70, No. 7, pp. 126–128.) Conclusion of 1478 of May.

621.395.625.3 **2463**

New Magnetic Recorder.—(*See* 2321.)

621.775.7 **2464**

Powder Metallurgy.—J. W. Lennox. (*Machinery, Lond.*, 3rd April 1947, Vol. 70, No. 1797, pp. 337–344.) An account of production methods for a wide variety of metal parts, including porous bronze bearings, iron dust cores, electrical contacts, hard-metal tools, etc. The advantages and limitations of the process are discussed.

621.785.5 : [669.71 + 669.715 **2465**

Surface Hardening of Aluminium and Its Alloys.—K. G. Robinson & B. W. Mott. (*Metallurgia, Manchr*, Feb. 1947, Vol. 35, No. 208, pp. 201–204.) By careful control of conditions throughout the process, it is possible to obtain a hard copper-rich surface layer of reasonably good uniformity.

621.791.3 : 620.197 **2466**

Soldering Litz Ends.—E. Toth. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 158..166.) An effective method consists of (*a*) burning the silk insulation and wiping off, (*b*) applying a paste of zinc chloride and water and heating with a soldering iron, (*c*) tinning immediately with resin-cored solder. With this method no trace of corrosion was found after equipment had been in service for 18 months in Panama.

621.791.353 : 669.018.21 **2467**

Metallic Joining of Light Alloys : Parts 3 & 4.—(*Light Metals*, March & April 1947, Vol. 10, Nos. 110 & 111, pp. 111–120 & 203–209.) Discussion of fluxes for soldering aluminium, theory and practice of hard solders and soldering for light alloys, the mechanical and corrosion properties of soldered joints, American investigations on soft-soldering practices for aluminium and the possibilities of supersonic vibration as an aid to the tinning of aluminium. Though no adequate theory of this last process is yet available, it is thought that the mechanical vibration removes the oxide film from the surface of the metal, so that true metal-to-metal contact is achieved. Practical details are discussed briefly. For a complete account by A. E. Thiemann of this process see *Automobiltechnische Zeitschrift*, 25th Dec. 1942, Vol. 45, No. 24, p. 688, of which an English summary was given in *Light Metals*, 1944, Vol. 7, No. 77, pp. 263–264. For parts 1 & 2 see 2152 of July. To be continued.

666.1 : 621.385.832 **2468**

Gas Heat Speeds Production of Electron Tubes.—(*Glass Ind.*, Feb. 1947, Vol. 28, No. 2, pp. 75–77.) Details of R.C.A. production technique for cathode-ray tubes.

669.28-154.4 **2469**

Ductile Melted Molybdenum.—(*Metal Ind., Lond.*, 7th Feb. 1947, Vol. 70, No. 6, pp. 106, 113.) Molybdenum is melted by an electric arc in vacuo and the resulting casting, after deoxidation with carbon, is sufficiently ductile for hot working.

669.71 + 669.715 **2470**

Aluminium Developments.—S. A. J. Sage. (*Metallurgia, Manchr*, Feb. 1947, Vol. 35, No. 208, pp. 193–196.) A survey of improvements in production methods and of new alloy developments.

669.71 : 6 **2471**

Aluminium 1946.—W. C. Devereux. (*Metallurgia, Manchr*, Feb. 1947, Vol. 35, No. 208, pp. 191–192.) A general review. The Government policy of holding large quantities of secondary stock idle is considered. The need for research and development in the industry is stressed.

669.718.4/.7 **2472**

Metallization with Aluminium.—C. R. Draper. (*Light Metals*, March 1947, Vol. 10, No. 110, pp. 124–160.) " An exhaustive study of all current techniques and equipment for the coating of metallic and non-metallic bases with aluminium. Theory and practice are considered in detail, with particular respect to the scope and economics of various fields of application."

669.718.6 : 621.385 **2473**

A Substitute for Nickel in Radio Valves.—(*Electronic Engng*, April 1947, Vol. 19, No. 230, p. 123.) The Telefunken Co. have produced a specially coated aluminium-iron sheet free from zinc, whose outstanding characteristic is that the surface changes from normal aluminium brightness to a dull dark grey on heating to 600°C in vacuo. This surface is an excellent radiator, comparable with the blackened surfaces at present used. The metal cannot be used with evaporated cathodes. Abstract of "Report on New Vacuum Tube Techniques" (Fiat No. 500), published by H. M. Stationery Office.

679.5 **2474**

Materials.—F. A. Freeth. (*J. R. Soc. Arts*, 11th April 1947, Vol. 95, No. 4740, pp. 333–339. Discussion, pp. 339–341.) A general account of the properties of polythene, methoxone, plastics and other new materials.

MATHEMATICS

512.831 : 535.13 **2475**

Matrix Representation of Maxwell's Equations.—J. Baudot. (*C. R. Acad. Sci., Paris*, 10th March 1947, Vol. 224, No. 10, pp. 735–737.)

512.972 : 537 **2476**

Tensors and Electricity.—L. Bouthillon. (*Ann. Radioélect.*, Oct. 1946, Vol. 1, No. 6, pp. 345–358.) Scalar, polar, axial and pseudoscalar quantities are defined and the different varieties of tensors to represent them described. The essential elements of the tensor calculus are presented, together with an original notation based on vector notation. Application of the results to electrostatics and magnetostatics shows that the two Coulomb theories of magnetism, as well as the classic Coulomb theory of electrostatics and Ampère's electrostatic theory can be developed in parallel, with interesting points of similarity and difference. Maxwell's equations are given in tensor notation and put into the most symmetrical form possible.

517.512.2 : 621.396.61 **2477**

Fourier Transform Analysis.—Levy. (*See* 2351.)

517.63 **2478**

A Generalization of Laplace's Transform.—R. S. Varma. (*Curr. Sci.*, Jan. 1947, Vol. 16, No. 1, pp. 17–18.) A generalization is given on which a new calculus is based. Five theorems of this calculus are stated, without proof.

517.941.9 : 53 **2479**

A New Method for Solving Certain Boundary Problems for Equations of Mathematical Physics permitting of a Separation of Variables.—G. A. Grünberg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 2, pp. 141–168. In Russian.) For problems of mathematical physics reducible to the integration of linear differential equations with separable variables and with linear boundary conditions, the well-known Fourier-Lamé method of partial solutions is normally used. This method is only a particular case of a more general and adequate method. As an example, the Laplace equations (1,1) for a rectangle are considered and the method of partial solutions is applied to Dirichlet's problem with boundary conditions (2,1) and (2,2). A complete solution is obtained but complications arise when the method is applied to Neumann's problem with boundary conditions (2,14). Consequently a solution in the form (2,27) is derived and it is emphasized that this is radically different from that obtained by the Fourier-Lamé method. The proposed method is then generalized and applied to the following problems : (*a*) the distribution of current in a uniform conducting cylinder when the current is admitted through a circular electrode AB on one of the ends of the cylinder and taken off from a ring electrode CD on its curved surface (Fig. 3), (*b*) the propagation of electromagnetic and acoustic waves in an infinite straight waveguide with a sectorial cross-section (Fig. 5), and (*c*), as (*a*) but where the cylinder consists of a number of coaxial cylindrical surfaces of different conductivities. An English version was noted in 1838 of June.

518.5 **2480**

Recent Developments in Calculating Machines.—(*Engineer, Lond.*, 4th April 1947, Vol. 183, No. 4758, p. 292.) Summary of I.E.E. Measurements Section discussion opened by D. R. Hartree. 'Analogue' and 'digital' types of machine were distinguished. The importance of a storage or 'memory' device was stressed. In particular, the I.B.M. automatic sequence-controlled calculator (787 of March and back references), and the ENIAC (462 of February) were briefly mentioned, together with a new American digital machine called EDVAC, which uses mercury vapour delay lines. Automatic indication of error from valve failure cannot yet be fully provided. A central Mathematical Institute will be needed to provide staff to advise on the capabilities of new machines.

518.5 **2481**

The ENIAC — High-Speed Electronic Calculating Machine.—M. V. Wilkes. (*Electronic Engng*, April 1947, Vol. 19, No. 230, pp. 105–108.) A general description, with photographs and some details of the principles of operation. The apparatus contains about 1 500 relays and 18 000 valves, the power consumption being 150 kW. The basic circuit is the flip-flop ; these are arranged in groups of 10 connected in rings so as to give a scale-of-ten counting system. All switching for the operational sequences involved in addition, multiplication, division, etc., is performed by means of pentode gate circuits. All the 2-μs pulses used in the Eniac have their origin in the cycling unit and their progress through the machine is controlled by gate valves. The numbers for the calculations are fed into the machine by means of punched cards of the kind used in the Hollerith accounting equipment. Memory, in the form of a storage device, and an adding machine are provided by units known as accumulators. A special unit carries out multiplication, making use of the method of partial products, the total time required for multiplication being about 14 addition times. Division is effected by repeated subtraction, the operating taking about 140 addition times, addition being performed in about 200 μs. Numbers from tables of functions may be set up in advance by the operator and can be transmitted in pulse form to any part of the machine when required. Pulse control is also used for selecting the operational sequences and making the necessary inter-unit connections, a 'master programmer' determining the successive routines and the number of times each process is repeated. The importance of such machines is stressed because of their ability to perform long and tedious calculations at high speed. See also 1928 and 2995 of 1946 and 462 of February.

518.5 : 621.3 **2482**
A Relay Computer for General Application.—S. B. Williams. (*Bell Lab. Rec.*, Feb. 1947, Vol. 25, No. 2, pp. 49–54.)

531.31 : 521.4 **2483**
On Nearly Periodic Motions.—F. Loonstra. (*Proc. Acad. Sci. Amst.*, Sept. 1946, Vol. 49, No. 7, pp. 744–751. In French.) A general discussion, with consideration of nearly periodic motions that can be physically realized.

MEASUREMENTS AND TEST GEAR

389.6 : 621.317.36 : 621.396.97(73) **2484**
Standard Frequency Broadcasts.—(*Wireless World*, April 1947, Vol. 53, No. 4, p. 132.) National Bureau of Standards transmissions are now radiated by WWV on four additional frequencies (20, 25, 30 and 35 Mc/s) and include regular warnings of radio propagation disturbances.

620.193.91 : 621.385 **2485**
Tubes Life Tested under Pulsed Operating Conditions.—(*Elect. World, N.Y.*, 8th Feb. 1947, Vol. 127, No. 6, pp. 33–34.) Equipment for life-testing receiving valves gives positive grid pulses, adjustable from 50 to 350 V. Pulse width is 1–25 μs and recurrence frequency 500–2 500 pulses per sec.

621.317.3.011.5 : 621.392.029.64 **2486**
On the Measurement of Dielectric Constant with the Aid of a Waveguide.—G. Fejér & P. Scherrer. (*Helv. phys. Acta*, 20th Jan. 1943, Vol. 15, No. 7, pp. 645–684. In German.) A magnetron oscillator and a rectangular waveguide are used in the band λ 1–3 cm for determining dielectric constant and absorption. A metal disk short-circuits one end of the waveguide and a plate of the material investigated is placed in front of it. The total phase change of the reflected wave is measured and its dependence on the thickness of the plate gives the dielectric characteristics of the material. The theory of the method is given and the advantages of using the H_{01} wave with crystals are explained.

621.317.32 : 578.088.7 **2487**
Method for Measuring High-Frequency Electric Fields and Its Use for Local Short-Wave Dosimetry.—K. S. Lion. (*Helv. phys. Acta*, 20th Feb. 1941, Vol. 14, No. 1, pp. 21–50. In German.) The brightness of the electrodeless discharge in a small gas-filled sphere is proportional to the field strength. The dependence of the brightness on all the factors involved is investigated. A reference was given in 2770 of 1941.

621.317.335 : 621.396.694.032.2 **2488**
Measuring Inter-Electrode Capacitances.—C. H. Young. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 68–70 . . 109.) New bridge, developed for measurement in h.f. valves of capacitances down to 2×10^{-3} pF.

621.317.34 **2489**
A Transmission Measuring Set for 0.1 to 11 c/s.—Bryden. (*See* 2511.)

621.317.341.029.6 **2490**
Attenuation Test Equipment for V.H.F. Transmission Lines.—F. A. Muller & K. Zimmerman. (*Télévis. franç.*, Feb. 1947, No. 22, Supplement *Électronique*, pp. 8–10.) Summary of 982 of 1946.

621.317.361 **2491**
The Identification of Harmonically Related Frequencies.—L. H. Moore. (*Electronic Engng*, April 1947, Vol. 19, No. 230, pp. 134–135.) A method for positive identification of the harmonic frequency with the minimum of apparatus. See also 3010 of 1945 (Anderson).

621.317.372 **2492**
Measurement of *Q*.—U. Zelbstein. (*Toute la Radio*, March/April 1947, Vol. 14, No. 114, pp. 121–123.) A simple description of indirect and of direct methods of measurement, with circuit diagrams of two *Q*-meters.

621.317.382.08 : 621.392.3 **2493**
R.F. Generator Load.—F. M. Leslie. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 105–108.) Describes the use of a short-circuited concentric transmission line with tap water as dielectric. The input impedance is calculated, and the input power may be found by measuring the temperature rise of the water flowing through the line.

621.317.7 + 621.38 + 621.396.69 **2494**
Physical Society Exhibition.—(*Electrician*, 4th–18th April 1947, Vol. 138, Nos. 3590–3592, pp. 847–849, 937–939 & 1014–1016; *Elect. Times*, 10th April 1947, Vol. 111, No. 2892, pp. 390–395; *Metal Ind., Lond.*, 18th April 1947, Vol. 70, No. 16, pp. 269–271; *Elect. Rev., Lond.*, 11th April 1947, Vol. 140, No. 3620, pp. 559–565; *Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 150–154). Various accounts of the apparatus and equipment exhibited.

621.317.7 + 621.396.69 **2495**
The R.C.M.F. [Radio Component Manufacturers' Federation] **Exhibition.**—(*See* 2376.)

621.317.7 **2496**
Measurement Apparatus at the [Paris] **Components Exhibition.**—(*Toute la Radio*, March/April 1947, Vol. 14, No. 114, pp. 115–116.) A short account, including descriptions of an oscilloscope, valve tester, impedance bridge, resistance and capacitance box, etc.

621.317.7 **2497**
Output Analyser.—P. Bernard. (*Toute la Radio*, March/April 1947, Vol. 14, No. 114, pp. 124–125.) An instrument exhibited at the Paris Components exhibition. It can be used as a wattmeter, a valve voltmeter, a distortion meter or a decibel meter and also permits simple measurement of the useful sensitivity of receivers.

621.317.7 : 621.396.96 **2498**
Test Equipment and Techniques for Airborne-Radar Field Maintenance.—E. A. Blasi & G. C. Schutz. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 310–320.) Techniques for measuring frequency, power, receiver sensitivity and performance characteristics of airborne radar equipment are outlined. Test apparatus designed

to carry out these measurements in the field is described with particular mention of 'passive type' instruments not requiring any operating power, such as echo boxes and directional couplers.

621.317.72 : 621.396.813 **2499**
Distortion Analyzer.—J. T. Goode. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 60–61 . . 144.) Constructional and circuit details.

621.317.725 **2500**
Stable Voltmeter.—R. W. Gilbert. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 130–133.) By using a plate follower circuit with compound feedback, a conductively coupled instrument of high stability is obtained. Zero drift is discussed and drift factors are given for the four basic degenerating networks.

621.317.733 : 621.316.89 **2501**
A Bridge Method for the Investigation of Non-Linear Resistors.—G. T. Baker. (*Phil. Mag.*, July 1946, Vol. 37, No. 270, pp. 498–502.) R_S ($= V/I$) is termed the steady resistance and R_F ($= \Delta V/\Delta I$) the fluctuation resistance. When $\Delta V/V$ is small, it is shown that for resistors satisfying the relation $V = CI^{\beta}$, $R_F = \beta R_S$, while for the more general equation $V = RI + CI^{\beta}$, $R_F = R + \beta R_S$. R_F and R_S are measured directly on a simple resistance bridge fed by an adjustable d.c. voltage with a small superimposed a.c. voltage which constitutes ΔV. The d.c. balance gives R_S on a suitably calibrated scale and the a.c. balance, with galvanometer cut out and a c.r.o. used as indicator, gives β directly. The method of calibration is fully described, practical bridge details are given and the accuracy of the method is discussed.

621.317.761 : 621.318.572 **2502**
A Pulse Counter Circuit and Its Adaptation as a Frequency Meter.—Lemas. (*See* 2346.)

621.317.761.078 **2503**
Description of a New Type of Frequency Meter and Its Application to Power Frequency Control.—F. Esclangon. (*Bull. Soc. franç. Élect.*, Jan. 1947, Vol. 7, No. 65, pp. 11–20.) Three arms of a Wheatstone bridge are pure resistances and the fourth a series resonant circuit. At the resonant frequency balance is obtained with suitable values of the resistances. For any other frequency an a.c. voltage is developed across one diagonal and is in quadrature with the supply voltage; it can be observed either by a moving-coil electrodynamometer or a rotating field instrument. The sensitivity is high and accuracy is little affected by harmonics. Simple additions to the instrument adapt it for frequency control.

621.317.761.087 **2504**
Direct Reading Frequency Meter of High Accuracy up to 100 Mc/s, with Recorder.—L. M. Berman. (*Onde élect.*, March 1947, Vol. 27, No. 240, pp. 87–93.) A rack-mounted equipment comprising a decade series of relaxation oscillators controlled by a 100-kc/s quartz crystal and ranging from 10 Mc/s to 10 c/s, a corresponding set of selectors and mixers with low-pass filters and valve voltmeters. An incoming frequency gives a series of beat frequencies with successively selected harmonics, the last digit being given by a direct-reading meter. Accuracy is to 1 part in 10^6.

621.317.79 : 621.385 **2505**
A Method of Measuring Grid Primary Emission in Thermionic Valves.—A. H. Hooke. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 471–478.) Reprint of 1598 of 1946.

621.317.79 : 621.396.62 : 621.396.622.63 **2506**
Crystal Diode reduces Probe Size.—A. Bein. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 52, 147.) Application to signal tracing of a germanium crystal diode test probe, which indicates difference in modulation or changes in the audio component of the signal. Operates in the frequency band 90 kc/s – 33 Mc/s.

621.317.79 : 621.397.62 **2507**
Television Synchronizing Signal Generating Units : Part 2.—R. R. Batcher. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 44–48. Correction, p. 127.) Method and equipment for combining picture and synchronizing signals, using the monoscope or image cameras. For part 1, see 1517 of May.

621.39.081 **2508**
Measurements in Communications.—N. B. Fowler. (*Elect. Engng, N.Y.*, Feb. 1947, Vol. 66, No. 2, pp. 135–140.) Includes a table, arranged for convenient reference, of some of the commoner measurement units and scales used in communication engineering.

621.396.822.08 : 621.396.62 **2509**
Visual Measurement of Receiver Noise.—Williams. (*See* 2570.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

621.317.32 : 578.088.7 **2510**
Method for Measuring High-Frequency Electric Fields and Its Use for Local Short-Wave Dosimetry.—Lion. (*See* 2487.)

621.317.34 **2511**
A Transmission Measuring Set for 0.1 to 11 c/s.—J. E. Bryden. (*Electronic Engng*, March & April 1947, Vol. 19, Nos. 229 & 230, pp. 77–81 & 125–130.) A general description of the instrument and its principles of operation, with comprehensive technical details of the circuits. Developed for use with biological and servo apparatus.

621.317.361 : 531.767 **2512**
Measuring Velocity of V-2 Rockets by Doppler Effect.—J. F. McAllister. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 56–59, 129.) Details of German high velocity measurement technique using a rocket-borne c.w. receiver-transmitter and a heterodyne method for measurement of the change of frequency.

621.317.761.078 **2513**
Description of a New Type of Frequency Meter and Its Application to Power Frequency Control.—Esclangon. (*See* 2503.)

621.365.5 + 621.365.92 **2514**
Induction and Dielectric Heating.—K. Pinder. (*Elect. Engng, N.Y.*, Feb. 1947, Vol. 66, No. 2, pp. 149–160.) The fundamental principles are outlined and various general types of operations are described where time, cost, equipment or material

can be saved. The types and sizes of units required in various cases are indicated.

621.365.5 **2515**

Heat Treatment of Highly Conducting Bodies by High-Frequency Eddy Currents.—M. Jouguet. (*Rev. tech. Comp. franç. Thomson-Houston*, Dec. 1946, No. 6, pp. 27–36.) Methods are given for calculating the distribution and power dissipation of eddy currents in a highly conducting solid bounded by any surface of the second degree, when placed in a uniform h.f. field of any orientation. Simplified practical calculations for h.f. furnaces are based on the determination of (*a*) the increase of the effective resistance of the heater winding due to the crucible and (*b*) the decrease of its reactance. The circular section normally used in h.f. furnaces can with advantage be replaced by an oval section. The use of partitions suitably fixed inside the furnace results in lower net and operational costs.

621.365.5 + 621.365.92] : 654 **2516**

Electronic Heating Units show Economy, Speed.—(*Electronic Industr.*, March 1947, Vol. 1, No. 3, pp. 2–3.) Discusses the economics of dielectric and induction heating and gives tables of (*a*) dielectric heating formulae and (*b*) processes in which h.f. heating can be used to reduce cost or increase speed.

621.365.92 : 621.396.662.21.042.15 **2517**

Baking Cores Dielectrically.—J. McElgin. (*Metallurgia, Manchr*, Feb. 1947, Vol. 35, No. 208, pp. 223–224.) With h.f. heating there is perfect control of time and temperature with no under- or overheating. Mass production methods become possible.

621.365.92.029.64 **2518**

Heating with Microwaves.—J. Marcum & T. P. Kinn. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 82–85.) "Suggested methods of utilizing waveguides for applying microwave energy to moving or stationary wires and threads, sheets or irregularly-shaped objects to achieve uniform dielectric heating, and survey of tubes offering possibilities for continuous operation."

621.369.2 **2519**

The Infra-Red Gas Burner.—L. Sanderson. (*Metallurgia, Manchr*, Feb. & March 1947, Vol. 35, Nos. 208 & 209, pp. 187–189 & 239–240.) High rate of heat transmission and low heat loss are claimed. Applications to many branches of industry are described.

621.38 : 6(048) **2520**

Industrial Electronic Equipment Uses.—W. C. White. (*Electronic Industr.*, March 1947, Vol. 1, No. 3, pp. 6–7.) A list of 154 papers, all in English, on industrial applications of electronics and on closely related subjects. For earlier lists see 2655 of 1946, and back references.

621.38.078 **2521**

The Electron Tube as an Element in Industrial Control.—R. R. Batcher. (*Electronic Industr.*, March 1947, Vol. 1, No. 3, pp. 16–17.) A chart giving typical valve circuits for a wide range of control purposes.

621.38.078 **2522**

Process Control by Electronic Instrumentation.—R. R. Batcher. (*Electronic Industr.*, Feb. 1947, Vol. 1, No. 2, pp. 12–13.) A chart illustrating various devices which sense the changes in a variable process and deliver a controlling signal to an electronic system.

621.38.001.8 **2523**

Industrial Applications of Electronic Techniques.—H. A. Thomas. (*Engineer, Lond.*, 21st & 28th March & 4th April 1947, Vol. 183, Nos. 4756, 4757 & 4758, pp. 247–248, 271–272 & 295–297.) Summary of I.E.E. paper. A detailed description, with numerous diagrams, of a wide variety of electronic devices for measurement, industrial instrumentation and control, production, inspection and protection. A bibliography of some 60 papers is included.

621.384.6 **2524**

Measurement of Out-of-Phase Magnetic Fields in Betatrons.—W. Bosley, J. D. Craggs & D. H. McEwan. (*Nature, Lond.*, 15th Feb. 1947, Vol. 159, No. 4033, pp. 229–230.) A method for detection and approximate measurement similar to that outlined in 1543 of May.

621.384.6 **2525**

Biased Betatron in Operation.—W. F. Westendorp. (*Phys. Rev.*, 15th Feb. 1947, Vol. 71, No. 4, pp. 271–272.) A schematic cross-section of the machine is given, with a diagram of the principal electrical components of the energizing circuit. No compensating or phase correcting circuits of any kind were used. With oil-cooled coils, the machine will produce 50-MV X-rays.

621.384.6 **2526**

F.M. Cyclotron.—F. R. (*Electronics*, March 1947, Vol. 20, No. 3, p. 119.) The cyclotron at the University of California has pole faces about 15 ft in diameter, with a 20-inch gap and a peak potential of 50 kV across the gap between the dees. The oscillator used to charge the dees is frequency modulated at 120 c/s between 12.5 and 8.17 Mc/s by a rotary vacuum capacitor.

621.384.6 (43) **2527**

European Electron Induction Accelerators.—H F. Kaiser. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 1–18.) The development of betatrons in Germany during and since the war is reviewed. Details are given of the constructional features of 6- to 15-MeV betatrons and of the theory and design of 15- and 200-MeV betatrons. The smaller units, especially the Siemens 6 MeV, are more advanced than comparable American units. No large machines were actually built, but the projected 200 MeV design presents novel features ; it would only weigh about 40 tons.

621.385.1.001.8 : 531.768.087 **2528**

Vacuum-Tube Acceleration Pickup.—W. Ramberg. (*Bur. Stand. J. Res.*, Dec. 1946, Vol. 37, No. 6, pp. 391–398.) A fixed indirectly-heated cathode has an elastically mounted plate on each side which is deflected when accelerations normal to the plates occur. Enough output is obtained at accelerations of the order of 10*g* to drive a recording galvanometer directly.

621.385.833 **2529**

New Electron Microscope.—(*Electrician*, 28th March 1947, Vol. 138, No. 3589, pp. 789–790.)

Summary and discussion of an I.E.E. Measurements Section paper entitled " The Design and Construction of a New Electron Microscope ", by M. E. Haine.

621.385.833 **2530**

The Magnetic Electron Microscope Objective : Contour Phenomena and the Attainment of High Resolving Power—J. Hillier & E. G. Ramberg. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 48–71.) The Fresnel diffraction fringes present in extra-focal images obtained withs mall angular aperture of illumination provide a sensitive criterion of the degree of symmetry of the objective. They also provide a relatively simple method for correcting asymmetry. Image quality with corrected lenses is much improved.

621.385.833 **2531**

On the Aberration of Electrostatic Lenses due to Ellipticity.—F. F. Bertein & E. Regenstreif. (*C. R. Acad. Sci., Paris*, 10th March 1947, Vol. 224, No. 10, pp. 737–739.) Formulae are derived for the limit of resolution imposed by the ellipticity and experiments are described which confirm the existence of the aberration.

621.386.1 **2532**

A High-Intensity Source of Long-Wavelength X Rays.—T. H. Rogers. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 236–241.) Description of an X-ray tube, giving radiation intensities of several million röntgens per minute over a 180° solid angle. Application to bactericidal and X-ray photo-chemical research is suggested.

621.386.84 **2533**

Application of Electronic Radiography to the Detection of Thin Organic or Mineral Layers.—J. J. Trillat & C. Legrand. (*C. R. Acad. Sci., Paris*, 3rd March 1947, Vol. 224, No. 9, pp. 645–646.) A plate of polished steel provides secondary electrons and its surface is covered with a very thin layer of cellulose paint, grease, oil, etc. Fine-grained photographic paper is applied and, after exposure and development, provides a measure of the layer thickness. The method is applicable to thicknesses from 0.001 mm to several hundredths of a millimetre. See also 1549 of May.

621.395.623 : 578.088.7 **2534**

A Simplified Encephalophone.—Conrad & Pacella. (*See* 2350.)

621.396.9 : 621.397.5 **2535**

Television takes to the Air.—McQuay. (*See* 2587.)

621.396.9.083.7 : 551.5 **2536**

Telemetering from V-2 Rockets : Part 1.—V. L. Heeren, C. H. Hoeppner, J. R. Kauke, S. W. Lichtman & P. R. Shifflett. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 100–105.) An account, with circuit diagrams, of the time-modulated pulse equipment carried in the nose of the rocket. The readings of 23 instruments are sampled successively and transmitted to the mobile ground station on a frequency of 1 000 Mc/s.

621.396.96 : 551.41 **2537**

New Radar Device.—(*Engineering, Lond.*, 14th Feb. 1947, Vol. 183, No. 4753, p. 181.) National Research Council, Canada, attempts to speed up map-making by flying aircraft fitted with a radar altimeter over uncharted territory ; a contour map of 200 square miles can be made in three hours.

621.398 : 621.43 **2538**

A Telecontrolled Motor Car.—S. Coudrier. (*T.S.F. pour Tous*, March 1947, Vol. 23, No. 221, pp. 63–65.) Details of the control equipment of a model car, 50 cm long. With a 15–30 W transmitter working on a wavelength of 4–6 m the control radius is 2–3 km.

621.398 : 629.13 **2539**

Teleguided Missiles.—J. A. Niland. (*Radio Craft*, Feb. 1947, Vol. 18, No. 5, pp. 24..57.) A review of the use of radio-controlled planes, bombs and rockets with brief descriptions of methods of control.

623.454.25 : 621.396.9 **2540**

The Optical Proximity Fuze.—F. A. Zupa. (*Bell Lab. Rec.*, Feb. 1947, Vol. 25, No. 2, pp. 70–74.)

623.454.25 : 621.396.96 **2541**

Guidance of Shells by Radio Brain [proximity fuse].—(*Télévis. franç.*, Feb. 1947, No. 22, Supplement *Électronique*, p.3.) The fuse VT, known as ' Madame X ', is a 4-valve receiver-transmitter of small dimensions, operating on radar principles and designed by R.C.A. It was fitted in the nose of shells used very successfully against V-1 projectiles.

623.454.25 : 621.396.96 : 621.385.3 **2542**

The Vibrotron.—J. V. (*See* 2624.)

621.3.078 **2543**

Electronic Control Handbook. [Book Review]—R. R. Batcher & W. Moulic. Caldwell-Clements, New York, 1946, 334 pp., $1.00 plus two years' subscription ($8.00) to *Electronic Industries*. (*Electronic Engng*, March 1947, Vol. 19, No. 229, pp. 100–101.) Believed to be the first book to present a general treatment of transducers from the viewpoint of the electronic engineer. Indispensable to those dealing with a wide range of electronic problems. A very favourable review.

621.38 **2544**

Electronic Engineering Handbook. [Book Review]—R. R. Batcher, W. Moulic and others. Caldwell-Clements, New York, 1944, 456 pp., 22s. 6d. (*Electronic Engng*, March 1947, Vol. 19, No. 229, pp. 100–101.) Deals mainly with fundamental valve types, circuits and applications. Valuable to those concerned with a wide range of electronic problems. A very favourable review.

PROPAGATION OF WAVES

535.13 **2545**

Quasi-Optical Links: Models of Ellipsoids [of diffraction] **and Spatial Aerials with Experimental Results.**—J. Dreyfus-Graf. (*Helv. phys. Acta*, 12th July 1944, Vol. 17, No. 4, pp. 245–250. In French.) See also 2058 of July.

538.566.2 **2546**

The Method of ' Phase Integral ' as applied to the Solution of the Problem of Propagation of Radio Waves around the Earth.—M. I. Ponomarev. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 2, pp. 189–195. In Russian.) The problem presents great difficulties, to overcome which Eckersley proposed the 'phase integral' method (1932 Abstracts, p. 514). An attempt to justify the method mathematically was made by him with Millington (3835 of 1938), and later by Millington alone (2640 of 1939).

The method is examined in the present paper and the following conclusions are reached: (*a*) it cannot be regarded as a new method for solving the diffraction problem since it is only a modification of Watson's method: (*b*) it has limited possibilities and the field intensity cannot be determined without resorting to the classical solution of the problem: (*c*) the introduction of Fresnel's reflection coefficient is not fully justified: (*d*) the existence of the modified Watson's series requires proof; the simplification of the differential equation is not justified.

621.396.11 : 621.396.93 **2547**

A New Source of Systematic Error in Radio Navigation Systems requiring the Measurement of the Relative Phases of the Propagated Waves.—Norton. (*See* 2429.)

621.396.11.029.45 : 551.510.535 **2548**

The Oblique Reflexion of Very Long Wireless Waves from the Ionosphere.—M. V. Wilkes. (*Proc. roy. Soc. A*, 27th March 1947, Vol. 189, No. 1016, pp. 130–147.) "An attempt is made to provide a satisfactory theoretical basis for a future discussion of the experimental data on the propagation of very long radio waves (18 800 m) given by Best, Ratcliffe & Wilkes, and Budden, Ratcliffe & Wilkes [3441 of 1939 and back references]. The reflexion of very long plane waves incident obliquely on a horizontally stratified ionized medium with a vertical magnetic field is first considered in general terms, and it is shown that the medium can be divided into a transition region and a reflecting region. If the ionization in the reflecting region increases linearly with height it is shown that propagation is governed by the equations:

$$\frac{\partial^2 L}{\partial \zeta^2} + (\alpha + \zeta)\ L + \beta M = 0,$$

$$\frac{\partial^2 M}{\partial \zeta^2} + (\alpha - \zeta)\ M + \beta L = 0,$$

where α and β are constants depending on the angle of incidence. Under the conditions of the experiments β is small, and a solution, in terms of contour integrals, valid in this case is obtained."

621.396.11.029.62/.64 **2549**

On the Propagation of Ultra-Short Electromagnetic Waves in the Zone of Direct Visibility.—S. Ya. Braude & I. E. Ostrovski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 2, pp. 225–234. In Russian.) The propagation of electromagnetic waves of wavelength 1 cm to 9 m over sea and land is discussed theoretically. The intensity of the field due to a vertical dipole is calculated for the case of a small elevation above the surface of the earth (which is assumed to be flat) of the transmitting and/or receiving dipoles. Certain conclusions are reached with regard to the depth and extension of the field when the dipoles are raised and also with regard to the effect of the operating frequency on the intensity of the field. The variation of the dielectric and conductivity properties of the medium with frequency and the effect of this on the field intensity of the dipole are examined. In studying the propagation of the waves along the surface of the earth, data are obtained on reflection coefficients different from those derived by Fresnel.

621.396.812 + 551.510.535] : 523.752 **2550**

Eruptions of the Solar Chromosphere and Their Influence on the Ionosphere and on Wave Propagation. Their Effects in Different Regions of the Radio Spectrum.—R. Bureau. (*Onde élect.*, Feb. 1947, Vol. 27, No. 239, pp. 45–56.) The main sources of information discussed are continuous records of the level of atmospherics on wavelengths in the neighbourhood of 10 000 m, together with records on various wavelengths between 20 m and 24 000 m. Comparison with results obtained in Great Britain for very long waves reveals a spectral effect which is interpreted as due to altitude. The sudden fade-outs on decametre waves and strengthening of long-wave signals are discussed. Some records on 2 000 m show, during the same eruption, successive fade-outs and strengthenings. This also is attributed to an altitude effect. February 1946 was marked by the passage across the solar disk of groups of spots and of eruptions larger than any previously observed. Examples are given of the radio effects then noted. The majority show simultaneous strengthening of long-wave signals and fade-outs on short waves. Two exceptional cases are discussed and also two cases of fade-out on 24 000 m. An explanation of the latter may be found in a particular structure of the abnormal D region.

2551

621.396.812 : 523.78 "1945.07.09" : 551.510.535

On the Results of the Ionosphere Measurements made during the Solar Eclipse of 9th July 1945.—Bulatoff. (*See* 2412.)

2552

621.396.812 : 523.78 "1945.07.09" : 551.510.535

Results obtained in observing the Propagation of Radio Waves during the Solar Eclipse of 9th July 1945.—Grigor'eva. (*See* 2411.)

621.396.812.029.64 **2553**

Attenuation of 1.25-Centimeter Radiation through Rain.—L. J. Anderson, J. P. Day, C. H. Freres & A. P. D. Stokes. (*Proc. Inst. Radio Engrs, W. & E.*, April 1947, Vol. 35, No. 4, pp. 351–354.) An account of an experimental investigation over a 6 400-ft optical path with nine equally spaced rain gauges. Readings were taken over 30-second intervals. Drop sizes were measured by the blotter method but no definite conclusions were obtained. The average measured attenuation was 0.37 db/mile/mm/hr, which is somewhat higher than Ryde's calculated value (515 of February).

RECEPTION

534.862.4 **2554**

Perfect v. Pleasing Reproduction — Discussion.—G. F. Redgrave : F. Slater : B. C. Sewell : F. Duerden : J. Moir. (*Electronic Engng*, April 1947, Vol. 19, No. 230, pp. 115–116.) Comments on 1185 of April and a reply by the author.

621.396.621 + 621.396.69 **2555**

Automatic Circuit Making. New Automatic Machine for Radio [receiver] **Production.**—(*Elect. Times*, 6th March 1947, Vol. 111, No. 2887, p. 237.) Summary of 1913 of June (Sargrove).

621.396.621 + 621.396.69 **2556**

Automatic Receiver Production.—(*Wireless World*, April 1947, Vol. 53, No. 4, pp. 122–123.) For a full account see 1913 of June (Sargrove).

621.396.621 **2557**

Measurements of Temperature of the Different Parts of a Radio Receiver and of the Oscillator Drift during Warming-Up Period.—I. L. Chakravarty. (*Indian J. Phys.*, Oct. 1946, Vol. 20, No. 5, pp. 193–195.) Tests on a Philips 595HN receiver. Temperature rise was highest (about 84°C) above the ballast tube. Near the i.f. transformer the temperature rose to 42°C. Stable conditions were reached in 2½ hours. The oscillator frequency decreased from 2 515 to 2 492 kc/s, corresponding to a temperature rise from 31°C to 35°C near the oscillator coil.

621.396.621 : 621.396.619.11 **2558**

The "Synchrodyne": A New Type of Radio Receiver for A.M. Signals.—Tucker. (*See* 2364.)

621.396.621 : 621.396.619.13 **2559**

Designing an F.M. Receiver: Part 1.—Roddam. (*See* 2365.)

621.396.621 : 621.396.681 **2560**

Rodina [receiver].—E. N. Genishta. (*Radio, Moscow*, April 1946, No. 1, pp. 32–38. In Russian.) Description of a battery-operated receiver, with details of construction and loudspeaker characteristics.

621.396.621.029.6 : 621.396.645 **2561**

I.F. Amplifier for High Gain F.M. Receiver.—Martin. (*See* 2368.)

621.396.621.029.64 : 621.396.96 **2562**

Considerations in the Design of Centimeter-Wave Radar Receivers.—S. E. Miller. (*Proc. Inst. Radio Engrs, W. & E.*, April 1947, Vol. 35, No. 4, pp. 340–351.) General principles of design and operation for duplex working. Typical circuit arrangements for various elements of the receiver, including the TR switches and automatic tuning unit, are described with particular reference to the 10 000–30 000 Mc/s frequency band. Average values for noise figures of the elements are given.

621.396.621.54 **2563**

Superregenerative Frequency Converter.—P. V. Trice & M. Barat, Jr. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 39..134.) Construction and operation details of an inexpensive converter for extending the range of existing types of communications receivers into the v.h.f. and u.h.f. regions. The circuit diagram of a 144-Mc/s unit is given.

621.396.621.54.029.56/.58 **2564**

A 5-Tube Ham Super.—C. V. Hays. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 62–63..120.) Constructional and circuit details of a receiver for the 10, 20, 40 and 80 m bands.

621.396.667 **2565**

Towards High Fidelity. Expansion Circuits.—R. Tabard. (*Télévis. franç.*, March 1947, No. 23, Supplement *Électronique*, pp. 10–13.) A general discussion of frequency expansion and compression, with circuit diagrams of various practical devices.

621.396.813 : 621.317.72 **2566**

Distortion Analyzer.—Goode. (*See* 2499.)

621.396.822 : 621.314.631 **2567**

Noise Spectrum of Crystal Rectifiers.—P. H. Miller, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 252–256.) A study in the frequency range from 50 c/s to 1 Mc/s. The measurement circuits are described. Noise temperature was found to vary inversely as the frequency.

621.396.822 : 621.396.621 **2568**

Specification and Measurement of Receiver Sensitivity at the Higher Frequencies.—J. M. Pettit. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 302–306.) An outline of the factors involved in measuring sensitivity and an attempt to evaluate their relative importance. The influence of receiver noise at higher frequencies has led to the specification of sensitivity in terms of noise figure and a method of measuring this quantity with a diode noise generator is introduced. To include both overall gain and noise threshold a combined sensitivity figure is proposed.

621.396.822 : 621.396.621.53 **2569**

Some Considerations governing Noise Measurements on Crystal Mixers.—S. Roberts. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 257–265.) A discussion of the principles of the analysis and measurement of noise in radio receivers. Noise generated in a crystal rectifier is analysed in terms of 'noise temperature'. The design of a noise-measuring set is discussed. It is found practicable to measure the noise temperature of a crystal rectifier independently of its impedance.

621.396.822.08 : 621.396.62 **2570**

Visual Measurement of Receiver Noise.—D. Williams. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 100–104.) A pulse-modulated carrier is injected into the receiver and the output observed on a c.r.o., the input being adjusted until an assigned relation between the magnitudes of the output pulse and the noise is observed. Results obtained with three variations of the method are discussed.

621.396.828 : 621.327.43 **2571**

Preliminary Study of Radio Interference as caused by Fluorescent Lamps in the Home.—L. F. Shorey & S. M. Gray. (*Illum. Engng, N.Y.*, March 1947, Vol. 42, No. 3, pp. 365–376.) Tests carried out on a number of fixed and portable lamps, mainly of the 32-W circular type, showed that by the use of metal wire screens and non-inductive capacitors, interference could be reduced to a tolerable level and in some cases eliminated altogether.

621.396.621.004.67 **2572**

Wireless Servicing Manual. [Book Review]—W. T. Cocking. Iliffe & Sons, London, 328 pp., 10s. 6d. (*Elect. Rev., Lond.*, 28th March 1947, Vol. 140, No. 3618, p. 480.) Revised edition. A book essentially for the repairer.

STATIONS AND COMMUNICATION SYSTEMS

003.62(100.1) : 621.396 **2573**

Call Signs of the Countries.—(*Radio, Moscow*, April 1946, No. 1, pp. 54–55. In Russian.) Includes details of the Russian Zones.

621.395.44 : 621.315.052.63 **2574**

Transmissions in Power Distribution Networks.—A. Chevallier. (*Onde élect.*, March 1947, Vol. 27, No. 240, pp. 79–86.) A description of methods used in the French grid system for carrier current telephony, the transmission of power measurements, including power exchanges with neighbouring grid systems, transmission to works of control orders after measurement of power and/or frequency, and transmission of information on synchronism and of signals necessary for the selective protection of the lines.

621.396.029.56/.58 **2575**

Amateur Frequency Bands.—V. S. Saltikoff. (*Radio, Moscow*, May 1946, No. 2, pp. 50–52. In Russian.)

621.396.65.029.64 **2576**

Microwave Communications System.—(*Electronics*, March 1947, Vol. 20, No. 3, pp. 138, 140.) Point-to-point relay equipment operating in the 2 450–2 700 Mc/s or 3 700–4 200 Mc/s bands. See also 265 of January.

621.396.65 Vanguard **2577**

H.M.S. Vanguard. Radio Communication Arrangements for the Royal Cruise.—G. M. Bennett. (*Wireless World*, March 1947, Vol. 53, No. 3, pp. 80–83.)

621.396.931 **2578**

Radio Communication in a French Marshalling Yard.—(*Engineer, Lond.*, 7th Feb. 1947, Vol. 183, No. 4752, p. 157.) For one-way working at Trappes a 25-W 166-Mc/s transmitter is used, with damp- and dust-proof receivers and loudspeakers in the shunting locomotives' cabs. Later equipment, comprising light-weight transmitter-receivers, gives a two-way communication range of 3 to 4 km.

621.396.931.029.62 **2579**

Radio Despatching for Taxicabs.—A. A. McK. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 97–99.) Some details of a two-way radio system now in operation in New Jersey, using f.m. on frequencies of 152.27 Mc/s and 157.53 Mc/s respectively.

621.396.97 (213) **2580**

Tropical Broadcasting.—" Radiator ". (*Wireless World*, April 1947, Vol. 53, No. 4, pp. 139–140.) Summary of and comment on 1942 of June.

SUBSIDIARY APPARATUS

621.314.632/.634 **2581**

Rectifiers : Selenium and Copper-Oxide.—W. H. Falls. (*Gen. elect. Rev.*, Feb. 1947, Vol. 50, No. 2, pp. 34–38.) A general account of their characteristics, including forward and leakage resistance, voltage rating, regulation, operating temperature, intermittent overload operation and aging.

621.314.634 : 621.396.621 **2582**

Selenium Rectifiers for Broadcast Radio Receivers.—E. W. Chadwick. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 464–467.) The high forward peak current rating of selenium rectifiers permits a larger input capacitance in power supply filters than is possible with diodes. The construction is described and practical circuits given.

621.318.5.077.8 **2583**

Capacity Operated Relays.—R. G. Rowe. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 50–51 . . 137.) Brief notes on four general types, and a detailed account of a method depending on changes of reflected resistance in the tuned circuit of a capacitance-controlled sensing element.

621.398 + 621.314.12 **2584**

Selsyns and Amplidynes.—F. Penin. (*Tech. mod.*, 1st/15th April 1947, Vol. 39, Nos. 7/8, pp. 126–129.) Describes the basic principles and applications of selsyns for telecontrol of angular position and of amplidynes in power amplification where electronic amplifiers are not practicable.

621.398 **2585**

Remote Control and Indication.—(*Elect. Rev., Lond.*, 14th March 1947, Vol. 140, No. 3616, p. 389.) Fundamental principles and brief constructional details of the ' Magslip ' transmission system. A basic element comprises two rotors with common a.c. feed, the stator windings being interconnected phase-for-phase so that no current flows between them when the rotors are in coincident angular positions. Displacement of one rotor upsets this balance and causes a corresponding displacement of the other rotor. Accuracy greater than 1° is possible.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26.029.64 **2586**

U.H.F. Television Relay System.—W. Boothroyd. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 86–91.) Wide-band f.m. equipment, operating on 1 350 Mc/s, for black-and-white video signals. Suitable either for inter-city multiple links or studio-to-transmitter work.

621.397.5 : 621.396.9 **2587**

Television takes to the Air.—J. McQuay. (*Radio News*, Feb. 1947, Vol. 37, No. 2, pp. 57–59 . . 102.) A review of the ' Block ' and ' Ring ' systems developed during the war and of proposed applications for a video news service.

621.397.5 (44) **2588**

Television throughout France. Coaxial [cable], **Hertzian** [radio] **Relays or Stratovision.**—Y. Angel. (*Télévis. franç.*, March 1947, No. 23, pp. 7–11.) A discussion of some of the problems connected with the construction of a national television network. Stratovision could serve 80% of France, containing 85% of the population, by means of three receiver-transmitter aircraft suitably located.

621.397.5 (44) **2589**

Incoherence.—M. Chauvierre. (*Radio franç.*, 1947, No. 4, p. 35.) Criticizes the lack of a decision as to the future line standard for television in France, but gives cogent reasons for the opinion that all the data necessary for making such a decision are not yet available.

621.397.5 (73) **2590**

Television in the U.S.A.—M. Chauvierre. (*Radio franç.*, 1947, No. 4, pp. 36–47.) A review of the television systems and services at present available, including the N.B.C., C.B.S. and Allen B. Dumont systems, with a detailed discussion of the rival colour television systems proposed by C.B.S. and by R.C.A. Receiver production is also considered. The author concludes that Europe need not envy

America regarding receivers, which in the U.S.A. must provide for 13 frequency bands. As regards quality of service, however, he considers much can be learned from the efficiency of private enterprise in the U.S.A.

621.397.6 : 621.385.832 **2591**
Experimental C.R. Tubes for Television.—F.R. (*See* 2629.)

621.397.61.029.63 **2592**
Color-Television Transmitter for 490 Mc/s.—N. H. Young. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 406–414.) Specifications and descriptions of a C.B.S. equipment with output 1 kW installed in the Chrysler Building, New York. The final amplifier stages all use 6C22 valves.

621.397.611 : 621.383 **2593**
Theory and Improvement of the Iconoscope.—R. Barthélemy. (*Télévis. franç.*, March 1947, No. 23, p. 17.) Short summary of paper presented at a meeting of the Television Section of the Société des Radioélectriciens, 15th Oct. 1946. For another account of the iconoscope see 917 of March.

621.397.62 **2594**
Postwar Television Receivers.—D. W. Pugsley. (*Elect. Engng, N.Y.*, March 1947, Vol. 66, No. 3, pp. 249–253.) Summary of A.I.E.E. paper. A general description of the design features and construction of the latest American receivers, including both direct-view and projection types.

621.397.62 **2595**
Television Receiver Construction : Parts 3 & 4.—(*Wireless World*, March & May 1947, Vol. 53, Nos. 3 & 5, pp. 103–107 & 164–169.) Frame coils are wound as plain slab coils and then bent to shape. Full details are given of winding formers, mounting board, final frame coil assembly, frame time base and synchronizing separator. For parts 1 & 2 see 1245 of April and 1953 of June.

621.397.62 **2596**
The Coudert Simplified Television Receiver.—A. Coudert. (*Radio en France*, 1947, No. 3, pp. 18–22.) An account of the principles, lay-out and circuits of an economical and simple receiver with only 22 valves.

621.397.62 : 621.317.79 **2597**
Television Synchronizing Signal Generating Units : Part 2.—Batcher. (*See* 2507.)

621.397.62 : 621.396.615.029.6 **2598**
The 6C5 and 54 Mc/s.—Pinot. (*See* 2359.)

621.397.62.018.078.3 **2599**
Automatic Frequency-Phase Control in TV Receivers.—A. Wright. (*Tele-Tech*, Feb. 1947, Vol. 6, No. 2, pp. 74–76, 127.) Interference which causes line instability is overcome by using a stable sine-wave oscillator for line synchronization. Variations in phase between the generated sine wave and the incoming synchronizing pulses produce a d.c. voltage which is used for automatic frequency correction of the oscillator.

621.397.621 **2600**
Interlacing.—W. T. Cocking. (*Wireless World*, April 1947, Vol. 53, No. 4, pp. 124–128.) Diagrams are given showing that regular timing and also similarity of waveform of successive timebase cycles are of great importance for good interlacing. To achieve this, careful design of the synchronizing pulse separator circuits and the saw-tooth generator is necessary.

621.397.645 : 621.396.615.17 **2601**
Electromagnetic Deflexion in Television.—(*Télévis. franç.*, Feb. 1947, No. 22, pp. 2–4.) Summary of 3086 of 1946 (Cocking).

TRANSMISSION

621.396.61 **2602**
Station in Lipstick Tube.—(*Sci. News Lett., Wash.*, 22nd Feb. 1947, Vol. 51, No. 8, p. 117.) A development from methods used in the proximity fuse. The circuits are painted on the envelope of a miniature valve and small batteries and a microphone complete the transmitter. Similar methods may give vest-pocket radio receivers and hearing aids.

621.395.61.029.56/.58 **2603**
10-kW Short-Wave Telegraph Transmitter, Type T.-H. 1343.—J. J. Brieu. (*Rev. tech. Comp. franç. Thomson-Houston*, Dec. 1946, No. 6, pp. 37–43.) A monobloc transmitter for transcontinental links. Six quartz-controlled frequencies are available and a high-stability auto-oscillator can be used on any frequency between 5 and 20 Mc/s.

621.396.61[.62].029.62 (52) **2604**
250-300 Mc/s Radiophone.—R. F. Scott. (*Radio Craft*, Feb. 1947, Vol. 18, No. 5, pp. 20–21.) Description of a Japanese portable transceiver having a horizontally polarized directional aerial and designed for speech or i.c.w. modulation. Photographs and circuit diagrams are given.

621.396.61.029.62 **2605**
A Three-Phase Rotating-Field Transmitter for Ultra-Short Waves.—W. Dieterle. (*Helv. phys. Acta*, 31st March & 8th May 1942, Vol. 15, Nos. 2 & 3, pp. 127–161 & 199–220. In German.) Three horizontal rods (tripole) excited with currents of equal amplitude but 120° phase difference provide a uniform radiation pattern. The theory of the three-wire feeder with star or delta terminations and the method of feeding it from the transmitter are described. The adjustments and monitoring of the transmitter, feeder and aerials are considered in detail with numerous diagrams. A radiated power of 300 W on λ 6.2 m is obtained on the system described.

621.396.65.029.63 **2606**
48-Channel F.M. Phone Transmitter.—A. van Weel. (*FM & Televis.*, March 1947, Vol. 7, No. 3, pp. 28–30 . . 61.) A transmitter for an u.h.f. link between the Philips factories at Eindhoven and Tilburg. Wavelengths used are 90.5 and 99 cm in the two directions. Modulation with frequencies from 12 to 204 kc/s, for 48 simultaneous calls, takes place on a carrier wave with a frequency $\frac{1}{8}$ of the transmitter frequency, the maximum frequency swing being 67 kc/s. A new method of interstage coupling simplifies the wiring. The transmitting valves used are QQE06/40 double tetrodes, which have a common screen grid for the two balanced systems and will give 40 W on λ 3 m or 30 W on λ 1 m.

VALVES AND THERMIONICS

621.317.7.085 **2607**

" Magic Eye " as Null Indicator.—D. A. Ward. (*Wireless World*, April 1947, Vol. 53, No. 4, p. 150.) Comment on 1255 of April. Circuit modifications are given for the EM34 which result in a sensitivity approximately the same as that of the pre-war EM1. *Note*. In 1255 of April EM2 should read EM1.

621.38+621.317.7+621.396.69 **2608**

Physical Society Exhibition.—(*See* 2494.)

621.385 : 620.193.91 **2609**

Tubes Life Tested under Pulsed Operating Conditions.—(*See* 2485.)

621.385 : 621.317.79 **2610**

A Method of Measuring Grid Primary Emission in Thermionic Valves.—A. H. Hooke. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 471–478.) Reprint of 1598 of 1946.

621.385 : [621.396.822+537.525.5 **2611**

Effects of Magnetic Field on Oscillations and Noise in Hot-Cathode Arcs.—Cobine & Gallagher. (*See* 2400.)

621.385 : [621.396.822+537.525.5 **2612**

Noise in Gas Tubes.—Cobine & Gallagher. (*See* 2401.)

621.385 : 669.718.6 **2613**

A Substitute for Nickel in Radio Valves.—(*See* 2473.)

621.385.032.3 **2614**

Carbide Structures in Carburized Thoriated-Tungsten Filaments.—C. W. Horsting. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 95–102.) The wide variety of carbide structures in the surface layers of such filaments is traced to carburizing conditions and subsequent processing during valve manufacture. A laminated structure frequently found contains less carbon than W_2C. Thyratron control of carburization is shown to be excellent, provided the filaments have uniform surface conditions and the hydrocarbon content in the hydrogen atmosphere is maintained. Abnormal filament current in valves is due to changes in thermal emissivity caused by surface conditions.

621.385 " 1920/1946 " **2615**

A Quarter Century of Electronics.—I. E. Mouromtseff. (*Elect. Engng, N.Y.*, Feb. 1947, Vol. 66, No. 2, pp. 171–177.) An outline of the main stages in the development of high-vacuum valves from the manufacturing standpoint.

621.385.1 **2616**

Recent Developments in Transmitting Valve Technique. A Series of Modern Valves.—R. Suart. (*Ann. Radioélect.*, Oct. 1946, Vol. 1, No. 6, pp. 391–408.) A concise review of new materials and methods of construction which have resulted in a great increase of maximum power, reduced inter-electrode capacitance and transit time and increased maximum operating frequency. Details are also given, with operational characteristics, of a series of valves made by the Société Française Radioélectrique, ranging from P2, a 2-W pentode of very small dimensions, to water-cooled 450-kW triodes.

621.385.1 : 621.386.16 : 548.0 **2617**

Usefulness of X-Ray Crystallography Examination in the Valve Industry.—Nguyen Thien-Chi. (*Ann. Radioélect.*, Oct. 1946, Vol. 1, No. 6, pp. 383–390.) Examples are given of a wide variety of tests, mainly employing X-ray diffraction, carried out on valve parts and materials from many stages of valve production.

621.385.1.012(47) **2618**

Radio Valves : Soviet Valves.—K. I. Drozdoff. (*Radio, Moscow*, April & May 1946, Nos. 1 & 2, pp. 39–44 & 37–41. In Russian.) Valve base data and tables of characteristics.

621.385.1.001.8 : 531.768.087 **2619**

Vacuum-Tube Acceleration Pickup.—Ramberg. (*See* 2528.)

621.385.1" 1939/1945 " **2620**

Electron Tubes in World War II.—J. E. Gorham. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 295–301.) Summary of advances made in design and performance of both transmitting and receiving valves used by the U.S. Army. Discussion of : improvements in cathodes, filaments and the alloys used to reduce grid emission; mode separation leading to anode strapping in magnetrons, for which methods of tuning and maximum power outputs are given ; characteristics of gas-filled TR tubes and the use of crystal rectifiers as mixers, detectors and d.c. restorers ; development of both klystrons and planar triodes for low power output requirements ; improvements in electron guns for c.r.ts ; various types of screen ; the use of low supply voltages for receiving valves ; improved protection against vibration ; and the trend towards miniature types.

621.385.3 **2621**

Triode Amplification Factors.—J. H. Fremlin, R. N. Hall & P. A. Shatford. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 426–435.) The validity of certain formulae for the amplification factor as a function of the ratio of wire diameter to grid pitch is discussed. Experiments with a triode of high shadow ratio, in which the anode/grid and grid/cathode spacings could be varied, indicate that Ollendorff's formula is the most accurate. The determination of amplification factor, for small anode/grid spacing, from a mechanical model agrees closely with a formula derived by one of the authors.

621.385.3 : 621.396.694.012.8 **2622**

Valve Equivalent Circuit.—B. Salzberg. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 124–125.) The constant voltage generator and constant current generator forms of equivalent circuit for a triode valve are compared. It is shown that they are equivalent as regards the external impedance, but not as regards the internal impedance unless the two impedances are equal. The constant voltage representation is considered to be the more fundamental. See also Howe's editorial, 2623 below, and back references.

621.385.3 : 621.396.694.012.8 **2623**

On the Use of Equivalent Circuits to represent the Valve.—G.W.O.H. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 97–99.) Editorial discussion of the valve equivalent circuit, confirming Salzberg's conclusions (2622 above). For earlier discussion see 949 of March and 1966 of June.

621.385.3 : 623.454.25 : 621.396.96 **2624**
The Vibrotron.—J.V. (*T.S.F. Phono-Ciné Électricité*, 10th March 1947, Vol. 23, No. 516, p. 17.) An R.C.A. miniature triode weighing only 2 gm, of the type used during the war for proximity fuses. The anode passes out through a metal diaphragm forming the end of the envelope and is terminated in a stylus. Mechanical vibrations applied to the stylus produce variations of inter-electrode capacitance. The triode may be used in a very light or sensitive pickup, or as a microphone if the stylus is replaced by a membrane of suitable surface area.

621.385.4 **2625**
Space-Current Division in the Power Tetrode.—C. M. Wallis. (*Proc. Inst. Radio Engrs, W. & E.*, April 1947, Vol. 35, No. 4, pp. 369–377.) The methods already used for the determination of the current division in a triode (435 of 1942) may be applied, in a modified form, to the power tetrode.

621.385.4 **2626**
Subminiature Electrometer Tube.—C. D. Gould. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 106–109.) A tetrode which requires only 13 mW for filament heating and has a very high input resistance. Applications to radiation meters are described.

621.385.82.032.29.027.3 **2627**
Ion Beams in High Voltage Tubes using Differential Pumping.—E. S. Lamar & W. W. Buechner. (*J. appl. Phys.*, Jan. 1947, Vol. 18, No. 1, pp. 22–27.) Focused hydrogen ion beam currents of 215 μA were obtained at the target end of a 6-ft tube operated at 300–400 kV. See also 2218 of 1941.

621.385.83 : 621.396.615.029.64 **2628**
The Multireflection Tube. A New Oscillator for Very Short Waves.—F. Coeterier. (*Philips tech. Rev.*, Sept. 1946, Vol. 8, No. 9, pp. 257–266.) The general principles of reflex oscillators are discussed. The new tube has a glass envelope 55 mm in diameter. An oxide cathode behind the aperture in a control electrode sends an electron beam through holes in the sides of a box-shaped anode. A $\lambda/4$ Lecher modulator system is located inside the anode, the repeller electrodes being outside. The anode is between the repeller electrodes and the cathode. Capacitive coupling to the Lecher system is used, with strip leads sealed through the envelope. With a magnetic field directed along the beam and an anode voltage of 3 000 V, an effective power of 15 to 20 W is obtained on a wavelength of 12 cm.

621.385.832 : 621.397.6 **2629**
Experimental C.R. Tubes for Television.—F.R. (*Electronics*, March 1947, Vol. 20, No. 3, pp. 112–115.) New tubes include one with a screen brightness of 300 foot-lamberts for monochrome receivers, a projection tube and a direct-viewing tube for polychrome receivers, and a tube with a very fast-response phosphor for use in photovision relaying.

621.385.832 : 666.1 **2630**
Gas Heat speeds Production of Electron Tubes.—(*See* 2468.)

621.396.615.141.2 **2631**
A Magnetron Oscillator with a Series Field Winding.—L. H. Ford. (*J. Instn elect. Engrs*, Part III, Jan. 1947, Vol. 94, No. 27, pp. 60–64.) A continuous-wave magnetron oscillator whose magnetic field is provided by an electromagnet energized by the anode current of the valve. Experiments were conducted over a frequency range of 40–750 Mc/s with two-segment-anode and four-segment-anode magnetrons, and oscillations were obtained over a large range of anode voltages. With the two-segment-anode magnetron, oscillations occurred at the fundamental frequency of the circuit connected to the valve; with the four-segment-anode magnetron, oscillations at 3, 5, 7 . . . times the fundamental appeared as the anode voltage was increased. During oscillation the anode current assumes the optimum field value. Danger from excessive anode current is largely removed and stability is good.

621.396.615.141.2 : 537.291 **2632**
Electron Trajectories in a Plane Single-Anode Magnetron — A General Result.—L. Brillouin. (*Elect. Commun.*, Dec. 1946, Vol. 23, No. 4, pp. 460–463.) A theorem previously developed for a plane diode (3883 of 1945) is extended as follows: if an arbitrary voltage variation is applied to the anode of a plane magnetron, electron trajectories will never cross each other provided (*a*) the current never becomes negative and (*b*) the current remains space-charge limited and saturation current is never obtained.

A method of computing the electron trajectories is discussed assuming 'single stream motion' where the electrons are unidirectional. The theorem is shown to hold for space charge limited current but when saturation is reached "inter-crossing of trajectories will occur near the end of the first 'double Larmor' period and the motion will become double stream". Electron trajectories are plotted using the method described. See also 75 of January.

621.396.622.63 : 621.317.79 **2633**
Crystal Diode reduces Probe Size.—Bein. (*See* 2506.)

621.396.694 : 538.3 **2634**
On the Helix Circuit used in the Progressive Wave Valve.—Roubine. (*See* 2339 & 2340.)

621.396.694.032.2 : 621.317.335 **2635**
Measuring Inter-Electrode Capacitances.—Young. (*See* 2488.)

MISCELLANEOUS

001.89 : 061.31 **2636**
British Commonwealth Scientific Co-Operation.—(*Nature, Lond.*, 22nd Feb. 1947, Vol. 159, No. 4034, pp. 257–259.) Comment on 2295 of July. See also 3828 of 1946 and 961 of March.

016 : 621.396"1945/1946" **2637**
Radio Progress during 1946.—(*Proc. Inst. Radio Engrs, W. & E.*, April 1947, Vol. 35, No. 4, pp. 399–425.) A review of the literature published during 1945 and 1946 containing some 750 references.

061.6(54) **2638**
The National Physical Laboratory of India.—K. N. Mathur. (*Nature, Lond.*, 8th Feb. 1947, Vol. 159, No. 4032, pp. 184–186.) A comprehensive scheme detailing the functions, organization,

staff, etc., for the laboratory to be erected at New Delhi, drawn up after consultation with the National Physical Laboratory, Teddington, and the National Bureau of Standards, Washington. The work to be carried out in the various sections is briefly described. An important division will be that of Electronics and Sound, which will include all aspects of electronic work and of acoustical measurements.

061.6(54) **2639**

National Research Laboratories of India.—S. Bhatnagar. (*Nature, Lond.*, 8th Feb. 1947, Vol. 159, No. 4032, pp. 183–184.) These will include a Physical, a Chemical and a Metallurgical Laboratory, a Glass and Ceramic Research Institute and a Fuel Research Iustitute. Their functions and the scope of the work to be carried out are outlined.

535.65-15 **2640**

On the Stability of Spectral Characteristics of Selenium Filters for Infra-Red Radiation.—A. V. Kurtener (Courtener) & E. K. Malyšev. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 475–477. In Russian with English summary.) The stability of filtration capacity was investigated for filters prepared by the deposition of selenium evaporated in vacuo upon rock salt. For at least three months after preparation, the characteristics of these filters remained unchanged in the range of wavelengths from 1–15 μ.

621.3+669] (73) " 1946 " **2641**

Research and Laboratory Investigations.—(*Gen. elect. Rev.*, Jan. 1947, Vol. 50, No. 1, pp. 12–15.) A review of developments in a wide field ranging from atomic energy to chemical and metallurgical research. Reference is made to (*a*) betatrons and synchrotrons giving very high accelerating voltages, (*b*) an X-ray photometer using a split beam from a single source, (*c*) Permafil-treated transformers and coils, (*d*) new alloys, (*e*) stainless wire for recorders, (*f*) a clear casting resin for obtaining surface replicas, and (*g*) new magnet alloys and materials, including Alnico-6 and Vectolite, a hardened, sintered combination of iron oxide and cobalt oxide which is non-conducting and light in weight.

621.3.016.25 **2642**

Sign of Reactive Power.—(*Elect. Engng, N.Y.*, Feb. & March 1947, Vol. 66, Nos. 2 & 3 pp. 206–208 & 321–323.) Comment on the recent recommendation of the A.I.E.E. Standards Committee noted in 971 of March; see also 1972 of June and back references.

621.362 **2643**

Sensitive High-Speed Radiation Thermocouple.—H. Cary & K. P. George. (*Phys. Rev.*, 15th Feb. 1947, Vol. 71, No. 4, pp. 276–277.) Summary of Amer. Phys. Soc. paper. The conditions are analysed for obtaining the maximum signal/noise ratio. A vacuum thermocouple designed for optimum performance at 10 c/s is described.

621.39 " 1939/1945 " **2644**

Telecommunications in War.—(*Electrician*, 28th March 1947, Vol. 138, No. 3589, pp. 777–778.) Summary of the speeches made by Sir Stafford Cripps and Col. Sir Stanley Angwin at the opening session of the I.E.E. Radiocommunication Convention.

621.395 Bell **2645**

Alexander Graham Bell, born 3rd March, 1847—died 2nd August, 1922.—G.W.O.H. (*Wireless Engr*, March 1947, Vol. 24, No. 282, pp. 65–67.) A short review of his life and work.

621.395 Bell **2646**

Alexander Graham Bell — Scientist.—F. J. Mann. (*Elect. Engng, N.Y.*, March 1947, Vol. 66, No. 3, pp. 215–236.) A detailed account of his life and work.

621.396 **2647**

Radio Convention.—R. L. Smith-Rose. (*Elect. Times*, 3rd April 1947, Vol. 111, No. 2891, pp. 351–353.) A review of about 100 papers presented at the I.E.E. convention, 25th March–2nd April, 1947, dealing with radio communication, broadcasting and certain types of navigational aid excluded from the 1946 Radiolocation Convention. The subjects covered by the principal papers included the wartime developments in radio, radio components and valve manufacture, long-distance transmission, special problems of naval, military and aircraft communications, radar pulse technique, propagation, broadcasting and direction finding for military and naval purposes. In many cases peacetime developments and applications were also indicated. See also 2648 and 2469.

621.396 **2648**

Radiocommunication Convention. I.E.E. Record of Seven Years' Progress.—(*Electrician*, 4th April 1947, Vol. 138, No. 3590, pp. 850–852, 854.) A list of the 16 main papers presented at the convention, with short summaries of four of them.

621.396 **2649**

Review of Radio Progress.—(*Electrican*, 4th April 1947, Vol. 138, No. 3590, pp. 853–854.) Summary of the concluding address by Sir Clifford Paterson at the I.E.E. Radiocommunication Convention. For another account see *Engineer, Lond.*, 4th April 1947, Vol. 183, No. 4758, pp. 293–294.

621.396.029.4/.6 **2650**

Classifying Frequencies and Wavelengths.—(*Wireless World*, April 1947, Vol. 53, No. 4, p. 117.) A plea for a generally acceptable classification, with criticism of existing systems. The classification proposed by the Inter-Services Radio Circuit Symbols Committee is favoured.

621.396 Bethenod **2651**

The Radio Work of Joseph Bethenod.—L. Bouthillon. (*Onde élect.*, Feb. 1947, Vol. 27, No. 239, pp. 65–74.) Reprint of 974 of March.

621.396 (083.72) **2652**

Glossary of Radio and Radar Terms.—(*Elect. Times*, 6th Feb. 1947, Vol. 111, No. 2885, p. 183.) I.R.C.S.C. Paper No. 38, " Interservice Radio Glossary ", published by the Central Radio Bureau, should be used by industry as well as the Services as a standard reference book.

621.3 **2653**

Electrical Engineering. [Book Review]—F. H. Pumphrey. Prentice-Hall, New York, 1946, 359 pp., $5.35. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1947, Vol. 35, No. 2, p. 190.) A textbook for students specializing in other fields.

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.13 **2654**

The Vibrations of Certain Coupled Systems.—Vogel. (*See* 2728.)

534.213(26.03) **2655**

Underwater Sound Propagation.—(*Tele-Tech*, April 1947, Vol. 6, No. 4, p. 39.) Experimental evidence is given of the existence of sound channels at depths of 300–400 ft in the Atlantic and 600–700 ft in the Pacific; their depth depends on the vertical temperature gradient.

534.32 : 621.396.722 **2656**

Distortion and Acoustic Preferences.—J. Moir. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, p. 495.) Comment on 612 of March. See also 2554 of August and back reference.

534.414 **2657**

Properties of Simple and Multiple Cylindrical Acoustic Resonators.—P. Wirz. (*Helv. phys. Acta*, 15th Feb. 1947, Vol. 20, No. 1, pp. 3–26. In German.) The fine structure of the resonance curves of acoustic resonators observed by Zickendraht (3030 of 1942) is found to be due to interference effects. A method is described for obtaining the true resonance curves and from them evaluating the decrement, which is in good agreement with the value obtained from photographic records of the amplitude of the oscillations excited by short-time application of a stimulus of the same frequency as that of the resonator. The well-known formulae for the frequency correction at the mouth of the resonator can be improved by the introduction of a term taking account of the width of the flange there. Experiments with bundles of similar tubular resonators are described, and a method is given for observation of the air motion at the mouth of an excited resonator.

534.845.1 **2658**

Measurement of Sound Absorption by Phase Shift Determinations.—G. Sacerdote. (*Alta Frequenza*, April 1947, Vol. 16, No. 2, pp. 98–100. In Italian, with English, French and German summaries.) The absorption of an acoustic material can be found from phase difference measurements at three points in a Kundt's tube.

534.861.1 **2659**

Acoustical Design of Broadcast Studios.—J. Peterson. (*Tele-Tech*, March 1947, Vol. 6, No. 3, pp. 52–55, 127.) A discussion of modern surface treatments to eliminate echoes and other objectionable features.

534.861.1 **2660**

The Acoustical Design of F.M. Studios.—E. J. Content. (*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 30–34.) A discussion of the factors involved in the improvement of overall frequency response and sound distribution in the studio.

534.88 **2661**

Sonar — The Submarine's Nemesis.—McProud. (*See* 2777.)

621.395.623 **2662**

Sensitivity and Impedance of Electro-Acoustic Transducers.—P. Vigoureux. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 19–30.) Using the method of equivalent electric circuits the output voltage is deduced in terms of the radiation resistance and the pressure. The radiation resistance can be measured by purely electrical means. The construction of impedance and admittance diagrams is explained, and it is shown how the maximum acoustic output can be obtained from electrical measurements without any acoustic measurements.

621.395.623 : 534.835 **2663**

Telephone Transmissions in Noisy Surroundings.—G. Nicolle. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 78–86.) The methods adopted to improve the signal/noise ratio usually involve some process favouring the signal, such as bringing the microphone close to the mouth of the speaker, and reducing the noise by insulation and making the apparatus as directional as possible. An alternative method proposed makes use of a differential action of two microphone elements, equally sensitive to the surrounding noise, with a directional arrangement allowing speech to affect only one of the elements. A very marked improvement in the signal/noise ratio is thus obtained without the use of sound insulation.

621.395.623.73 **2664**

Wide Range Loudspeaker Developments.—H. F. Olson & J. Preston. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 155–178.) A reprint was abstracted in 993 of April.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.392.029.64 **2665**

Guided Waves in a Coaxial Line.—G. Goudet & J. Lignon. (*Onde élect.*, April 1947, Vol. 27, No. 241, pp. 152–159.) Discussion of propagation in the annular space of coaxial cables to see whether normal cables can be used for u.h.f. transmission. Coaxial cables should be designed for propagation only of the fundamental wavelength. At the higher frequencies waveguides should be used.

621.315.212 : 621.397.74 **2666**

The Provision in London of Television Channels for the B.B.C.—H. T. Mitchell. (*P.O. elect. Engrs' J.*, April 1947, Vol. 40, Part 1, pp. 33–36.) An account of recently installed coaxial cable and the associated repeater equipment.

621.315.213.12 : 621.397.5 **2667**

Development of an Ultra Low Loss Transmission Line for Television.—E. O. Johnson. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 272–280.) A 300-Ω parallel-wire polyethylene dielectric feeder having an attenuation less than 0.8 db per 100 ft at 50 Mc/s. It is weatherproof and cheap to manufacture.

621.38/.39].029.64 **2668**

Microwave Electronics.—J. C. Slater. (*Rev. mod. Phys.*, Oct. 1946, Vol. 18, No. 4, pp. 441–512.) This comprehensive article is essentially a set of notes for lectures delivered during the winter of 1945–46. It is written from the standpoint of a physicist and includes chapters dealing with (*a*) the four-terminal network and the transmission line, (*b*) waveguides, (*c*) resonant cavities, (*d*) applications of the theory of resonant cavities, (*e*) electronics of the reflex klystron and magnetron.

621.392.029.64 **2669**

On the Transmission of H_0 Waves in Guides of Circular Cross-Section.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 31st March 1947, Vol. 224, No. 13, pp. 998–1000.) In a straight guide the H_0 wave is practically stable for accidental curvatures which on the average balance out, but its attenuation only approximates to the theoretical value if these curvatures are very small. See also 1667 of June and back references.

621.392.21 **2670**

Propagation Characteristics of a Uniform Line.—C. Micheletta. (*Alta Frequenza*, Feb. 1947, Vol. 16, No. 1, pp. 47–49. In Italian.) Simple formulae are derived for the attenuation and phase constants, using results given by Macdiarmid & Orchard (2476 of 1946).

621.392.22 **2671**

Non-Uniform Transmission Lines and Reflection Coefficients.—L. R. Walker & N. Wax. (*J. appl. Phys.*, Dec. 1946, Vol. 17, No. 12, pp. 1043–1045. Summary in *Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 393.) A first-order differential equation for the voltage reflection coefficient of a non-uniform line is derived and is applied to the calculation of the resonant wavelengths of tapered lines.

621.392.4.029.58 + 621.396.67.029.58] : 621.317.3 **2672**

The Testing of High-Frequency Aerial Systems & Transmission Lines.—E. J. Wilkinson. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1947, Vol. 8, No. 2, pp. 4–20.) A full description of the aerial arrays and transmission lines used at Shepparton, Victoria, Australia, for operation on frequencies between 6 and 22 Mc/s and the theoretical considerations underlying their design. The procedure for setting up and testing the system is given in detail. A series of appendices deal with switching and matching stubs, transmission-line unbalance, behaviour of $\lambda/4$ and $\lambda/2$ lines and evaluation of line terminations.

621.392.43 : 621.317.33 **2673**

Impedance Measurement on Transmission Lines.—D. D. King. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 509–514.) "A derivation of the formulas available for the measurement of terminal impedances on transmission lines is given in terms of hyperbolic functions. The accuracy and usefulness of a number of different methods are considered. Results are obtained in a form suitable for convenient application to practical measuring problems involving standing-wave and resonance-curve methods."

621.392.43 : [621.317.72.029.56/.58 **2674**

The "Micromatch".—Jones & Sontheimer. (*See* 2853.)

621.396.615.141.2 : 621.314.2.029.64 : 621.315.613.7 **2675**

Waveguide-Output Magnetrons with Quartz Transformers.—Malter & Moll. (*See* 2712.)

621.396.67 **2676**

Recent Theories of the Aerial : Part 4.—É. Roubine. (*Onde élect.*, April 1947, Vol. 27, No. 241, pp. 160–169.) Conclusion of 2012 of July and 2332 of August. Outlines are given of a symbolic method for the integration of the Hallén equation and of the methods of King & Harrison (1933 and 1934 of 1944), of Bouwkamp (2197 of 1944), of King & Middleton (1771 of 1946) and also of the modifications of Hallén's theory suggested by Miss Gray (1931 of 1944). It is impossible at present to decide which of these theories is best, owing to the difficulty of measuring input impedance accurately.

621.396.67 **2677**

2 500-foot Vertical Antenna.—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 188, 190.) A German aerial system supported by an electrically driven, captive helicopter.

621.396.67.029.64 **2678**

Microwave Omnidirectional Antennas.—H. J. Riblet. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 474–478.) Design considerations for omnidirectional 3-cm and 10-cm aerials are summarized. Elements used in the construction of aerials of this type are described.

621.396.67.029.64 **2679**

Parallel Plate Optics for Rapid [aerial] **Scanning.**—S. B. Myers. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 221–229.) Consideration of the problem of shaping two curved parallel plates, between which the energy feed is placed so that circular motion of the feed will produce an oscillating beam at a straight aperture. The latter serves as a line source for a bifocal reflector which facilitates the desired scanning. The method was developed to obviate rapid movement of parabolic aerials.

621.396.67 : 517.512.2 **2680**

Fourier Transforms in Aerial Theory : Part 1.—J. F. Ramsay. (*Marconi Rev.*, Oct./Dec. 1946, Vol. 9, No. 83, pp. 139–145.) " The radiation pattern of a narrow-beam aerial can be formulated as the Fourier Transform of the aperture excitation. Examples are given of simple equiphase aperture characteristics and the evaluation of the corresponding polar diagrams. Four basic patterns are plotted, corresponding to the symmetrical, in-phase excitations known as ' constant ', ' triangular ', ' cosine ', and ' cosine squared '."

621.396.671 **2681**

Partially-Screened Open Aerials.—R. E. Burgess. (*Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 145–149.) " A simple approximate theory based on the transmission-line equations is developed for an open aerial, a portion of which is enclosed in a concentric conducting screen. The voltage and current distributions in the transmitting case are deduced. From these the effective heights of the ' screened ' and unscreened portions of the aerial are calculated and it is found that as the length of the unscreened portions increases so the effective height of the screened portion tends to equality with its length, as was first demonstrated experimentally by Smith-Rose and Barfield.

" The susceptance of the aerial is calculated on the assumption of no losses and it is found that the anti-resonant frequencies are displaced by the presence of the screens while the resonant frequencies occur when the length of the inner conductor or of the screen is equal to an odd number of quarter-wavelengths.

"A simple equivalent circuit is given for an aerial which is short compared with the wavelength."

621.396.671.4 **2682**

Radiation Resistance of Horizontal and Vertical Aerials carrying a Progressive Wave.—E. M. Wells. (*Marconi Rev.*, Oct./Dec. 1946, Vol. 9, No. 83, pp. 129–138.) An extension of L. Lewin's analysis (2332 of 1939) to the case of progressive waves, using van der Pol's method.

621.396.674 **2683**

Design Values for Loop-Antenna Input Circuits.—J. E. Browder & V. J. Young. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 519–525.) A theoretical treatment of the problem leading to formulae and charts for the choice of inductances, Q values and coupling coefficients of loop-aerial coupling transformers for obtaining optimum signal/noise ratio. The case of cable connection of the loop to the receiver is also considered.

621.396.677 **2684**

Aircraft Antenna Pattern Plotter.—O. H. Schmitt & W. P. Peyser. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 88–91.) If measurements are made on a scale model of an aircraft and its aerials, the signal wavelength being proportionately reduced, the actual radiation pattern of the full-size installation can be predicted. Technical details of a system using microwaves and automatic recording are given.

621.396.677 **2685**

A Current Distribution for Broadside Arrays which optimizes the Relationship between Beam Width and Side-Lobe Level.—C. L. Dolph : H. J. Riblet. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 489–492.) Discussion of 2487 of 1946. Riblet gives a generalization of Dolph's methods which removes the limitations that (*a*) the spacing between radiators $\geqslant \lambda/2$; (*b*) the beam width is characterized by the existence of a first null ; (*c*) the current distribution is in phase ; (*d*) the current distribution is symmetrical about the centre position of the array.

In his reply Dolph shows how the calculations necessary in the application of his methods may be simplified.

621.396.677 : 621.396.93 **2686**

Various Papers on Direction-Finding.—(*See* 2780 to 2783.)

621.396.677.029.64 : 538.566 **2687**

Electromagnetic Fields in a Paraboloidal Reflector.—E. Pinney. (*J. Math. Phys.*, April 1947, Vol. 26, No. 1, pp. 42–55.) Continuation of the mathematical treatment of 1909 of 1946. The case of a radiating dipole backed by a dummy reflector, both dipoles being perpendicular to the axis of the paraboloid, is considered in detail.

621.396.679.4 : 621.315.24 **2688**

A Six-Wire Transmission-Line Application.—J. C. Wadsworth : A. J. E. Robertson. (*Proc. Instn Radio Engrs, Aust.*, March 1947, Vol. 8, No. 3, pp. 16–17, 19.) Comment by Robertson on 1686 of June and the author's reply.

621.392.029.64 + 621.396.67 **2689**

The Physical Principles of Wave Guide Transmission and Antenna Systems. [Book Review]—W. H. Watson. Oxford University Press, 207 pp., 20s. (*Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 154–155.) " Its aim is to describe to physicists and engineers with theoretical interests the way in which the technique of handling radio-frequency transmission lines has been extended to deal with waveguides . . . The book can be unreservedly recommended to anyone in any way interested in waveguides."

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2.015.33.029.5 **2690**

Electromotive Impulse Transformer.—B. Lavagnino & V. Zerbini. (*Alta Frequenza*, Feb. 1947, Vol. 16, No. 1, pp. 31–36. In Italian, with English, French and German summaries.) The heavily damped two-winding moving-coil galvanometer can transfer the time integral of an e.m.f. of short duration from one winding to the other at a constant ratio. Such a device might be used as a coupling transformer for pulse amplifiers.

621.316.722 **2691**

Nonlinear Limiter.—E. R. Brill. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 198..202.) A limiter using germanium crystal rectifiers whose current/potential characteristic follows a cube root law. When the limiter is used in combination with a cathode-ray screen with a cube law a linear overall transfer characteristic is obtained.

621.316.935 **2692**

Negative Resistance Effects in Saturable Reactor Circuits.—J. M. Manley & E. Peterson. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 870–881.) General properties of oscillations produced; three types distinguished, incommensurable, subharmonic, and harmonic. Experimental data are in general agreement with theory.

621.318.323.2.042.15 **2693**

Iron-Dust Cores.—Gleadle. (*See* 2816.)

621.318.33.042.029.3 **2694**

Magnetic Parameters in the Calculation of Reactors and Transformers for Audio-Frequency.—G. Monti-Guarnieri. (*Alta Frequenza*, Feb. 1947, Vol. 16, No. 1, pp. 3–30. In Italian, with English, French and German summaries.) Methods of calculation involve three dimension ratios, defining the shape of the laminations and core, and also a 'parallel-harmonic' permeability depending on the ratio B/H. Nonlinear distortion is discussed and corrections are applied in the calculation of polarized and non-polarized reactors to account for distortion limitation. An appendix describes apparatus and methods for determining the magnetic parameters and graphs used.

621.318.572 **2695**

Electronic Counters.—I. E. Grosdoff. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 438–447.) The use of resistance-coupled multivibrators in ring-chain and series-chain counters is described; gate and switching problems are discussed and applications suggested.

621.318.7 **2696**

Insertion Loss and Insertion Phase Shift of Multi-Section Zobel Filters with Equal Image Impedances.—W. Saraga. (*P.O. elect. Engrs' J.*, Jan. 1947, Vol. 39, Part 4, pp. 167–172.) The method given in 1045 of 1943 (Stanesby, Broad & Corke) can be applied to any given filter network which possesses a lattice equivalent. To simplify the derivation of these lattice equivalents for multi-section Zobel filters with equal image impedances, the reactance/frequency functions of a large number of such filters are tabulated.

621.318.74 **2697**

Narrow Band-Pass Filter using Modulation.—N. F. Barber. (*Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 132–134.) The signal is modulated in two channels by equal voltages in phase quadrature, and the products are passed through low-pass filters, then further modulated by quadrature voltages and recombined. The final frequency is the same as that of the original signal and phase changes are preserved.

621.319.5.015.33 **2698**

Generation of Pulse Voltages.—L. Vallese. (*Alta Frequenza*, April 1947, Vol. 16, No. 2, pp. 68–86. In Italian, with English, French and German summaries.) Fundamental principles, with typical circuits and some experimental results.

621.392.5 **2699**

Minimum Phase-Shift Networks.—L. A. Zadeh. (*Wireless Engr*, May 1947, Vol. 24, No. 284, p. 157.) Discusses briefly the suggestion that such networks should be termed 'minimum net phase-shift networks', where 'net phase-shift' is defined as the total angle swept by G (the complex gain of the network) in the G-plane when ω varies from zero to the value in question.

621.392.5.016.24/.25 **2700**

On the Calculation of the Active and Reactive Power of Certain Electrical Networks.—M. Parodi. (*Rev. gén. Élect.*, March 1947, Vol. 56, No. 3, pp. 143–144.) Expressions for the active and reactive power of a dissipative network, in terms of its input reactance and of the constants characterizing the losses, are derived from a relation due to N. I. Korman (738 of 1945).

621.392.52 : 621.396.611.21 **2701**

Crystal Filters.—I. Edvin. (*Elektrotechnika, Budapest*, March 1947, Vol. 39, No. 3, pp. 41–47. In Hungarian, with English, French and German summaries.) The behaviour of lattice and other types of filter sections is described and results obtained for band-, low- and high-pass filters are discussed. Methods of soldering connecting wires to nodal points of the crystal are described. Balls of solder may be used on the supporting wires to create artificial reflection points.

621.396.611.1 **2702**

An RC Circuit giving Over-Unity Gain [at a particular frequency].—C. L. Longmire. (*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 40–41, 112.) Applications are discussed.

621.396.611.21 + 537.228.1 **2703**

Quartz Oscillators.—P. Vigoureux. (*J. Brit. Instn Radio Engrs*, March/April 1947, Vol. 7, No. 2, pp. 46–62.) General review of subject; methods of cutting, nature of equivalent circuit, oscillator characteristics, applications to frequency multiplication and division, clocks and filters.

621.396.611.21 : 621.316.726 **2704**

Stability of Crystal Oscillators.—A. J. Zink, Jr. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 127–129.) Discussion of factors affecting crystal oscillator frequency drift and methods of minimizing it.

621.396.611.3 **2705**

On a Formula relative to the Reflection of Waves.—P. Marié. (*C. R. Acad. Sci., Paris*, 10th Feb. 1947, Vol. 224, No. 6, pp. 379–381.) The interpretation of a formula derivable from the papers noted in 1376 and 1377 of May.

621.396.611.4 : 537.533 **2706**

Cavity Resonators and Electron Beams.—J. H. Owen Harries. (*Wireless Engr*, March–May 1947, Vol. 24, Nos. 282–284, pp. 71–80, 109–118 & 135–142.) General theoretical treatment of fundamental principles and limitations in radio-valve technique using a modulated electron beam supplying power to a load through a resonator. Energy transfer and power output conditions are analysed; it is shown that the maximum theoretical conversion efficiency η_0 is 43%, attained when the small-signal transit angle is about $\pi/2$ and the ratio of the peak voltage in the resonator along the beam to the steady voltage at entry is rather greater than unity. The overall efficiency is $\eta_0\eta_c$ where η_c is the efficiency of transfer from resonator to load. In a given system the adjustable parameters are the beam current and the resonator-load coupling, and the criteria for obtaining maximum overall efficiency are discussed.

The influence of wavelength on the efficiency and power output given by present electron-stream-resonator technique is considered in detail; it is concluded that this technique is only useful down to wavelengths of about 1 cm. Application of the theory is exemplified by considering specific shapes of resonator.

Techniques for measurement of Q and of electric field and field integrals at microwavelengths and the use of models are discussed.

621.396.615 : 621.316.726 **2707**

Frequency Instability of Self Oscillators.—E. Green. (*Marconi Rev.*, Oct./Dec. 1946, Vol. 9, No. 83, pp. 151–158.) The conditions for single-frequency operation are analysed for an oscillator connected through a long line to an unmatched load.

621.396.615.14 **2708**

Improving Stability of U.H.F. Oscillators.—C. A. Helber. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 103–105.) Mathematical analysis of the factors governing frequency stability during load impedance changes, and a method of reducing frequency variations in a 1 000-Mc/s oscillator by means of a series capacitor in the anode circuit.

621.396.615.14 **2709**

Microwave Oscillators using Disk-Seal Tubes.—A. M. Gurewitsch & J. R. Whinnery. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 462–473.) Typical design and performance data are given for oscillators using three disk-seal valves now on the market. "A general small-signal oscillator theory is presented and applied to the re-entrant disk-seal-tube microwave oscillator. It is shown how information on frequency of oscillation, tuning, and frequency stability can be obtained."

621.396.615.14 **2710**

Generating Microwaves.—S. Freedman. (*Radio News*, March 1947, Vol. 37, No. 3, pp. 35–37 . . 128.) A general account of the various methods employed, from the Barkhausen-Kurz stage onwards, with a table in which these methods are compared as regards the energy interchange, output, energy losses, ease of adjustment, frequency flexibility and cost. A short description is also given of the Fonda-Freedman method, which uses ordinary valves with special circuit arrangements.

621.396.615.14.012.2 **2711**

Q Circles—A Means of Analysis of Resonant Microwave Systems: Part 2.—W. Altar. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 478–484.) Mathematical proof of the relationships on which are based the circle diagrams described in part 1 (2360 of August).

621.396.615.141.2 : 621.314.2.029.64 : 621.315.613.7 **2712**

Waveguide-Output Magnetrons with Quartz Transformers.—L. Malter & J. L. Moll. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 414–421.) Tests at a wavelength of 1.25 cm show that quartz dielectric waveguide, or parallel-plate transmission-line transformers give performance substantially identical with that obtained with vacuum transformers. The use of quartz increases transformer width and reduces the length.

621.396.619.13 : 621.396.622 **2713**

Applying the 1N34 as Discriminator for F.M.—N. L. Chalfin. (*Radio News*, March 1947, Vol. 37, No. 3, pp. 55, 150.) The germanium 1N34 crystal provides greater output with less residual hum than a conventional 6H6 valve. A discriminator circuit is given which uses two 1N34 units or a single 1N35. The latter consists of two matched 1N34s.

621.396.619.16 **2714**

A Note on a Phase Modulator Principle.—R. A. Wooding, Jr. (*Proc. Instn Radio Engrs, Aust.*, April 1945, Vol. 5, No. 8, pp. 13–16, 24.) A practical circuit for producing quasi-phase modulation.

621.396.645 **2715**

Design for a High-Quality Amplifier.—D. T. N. Williamson. (*Wireless World*, April & May 1947, Vol. 53, Nos. 4 & 5, pp. 118–121 & 161–163.) Discussion of the basic requirements, the design of the push-pull output stage, the output transformer and phase-splitter and driver stages. A practical circuit is shown using tetrode output valves connected as triodes and details of the performance and effect of feedback are given.

621.396.645 **2716**

Design of Transmission Line Tank Circuits.—W. C. Hollis. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 130–134.) A discussion of tank efficiency, condition for resonance, selectivity, impedance of tank circuit, and conditions for maximum impedance with graphical design procedure.

621.396.645 : 518.3 **2717**

Cathode Follower Nomograph.—M. B. Kline. (*Electronics*, May 1947, Vol. 20, No. 5, p. 136.) Relates gain, amplification factor and ratio of cathode load resistance to valve anode resistance.

621.396.645 : 621.396.822.08 **2718**

Linearity Range of Noise-Measuring Amplifiers.—R. L. Bell. (*Wireless Engr*, April 1947, Vol. 24, No. 283, pp. 119–122.) In the amplification of noise voltages there is a finite probability of the occurrence of any peak value of voltage, however large, and all those greater than a certain value will produce overloading of the amplifier.

The errors in mean and mean square output voltages resulting from an assumption of linear amplification are calculated in the two cases of amplifiers with resistive and selective output loads.

621.396.645.36 **2719**

Cancellation of Even Harmonic Distortion in Push-Pull Operation.—G. F. Craven & G. R. O.

Vermeir. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1945, Vol. 5, No. 7, pp. 12–19.) Analysis for class A, AB, B and C amplifiers.

621.396.662.21 **2720**
Universal Coil Design.—A. W. Simon. (*Radio, N.Y.*, Feb./March 1947, Vol. 31, No. 2, pp. 16–17.) Simple formulae for coil winding.

621.396.69 + 621.396.621 **2721**
Machine for Receiver Manufacture.—(*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 163–164.) A short account of the equipment described in 1913 of June (Sargrove).

621.396.69 : 06.064 **2722**
Component Design Trends.—(*Wireless World*, May 1947, Vol. 53, No. 5, pp. 177–181.) A review of the Radio Component Manufacturers' Federation exhibition held in March 1947.

517.432.1 **2723**
Heaviside's Operational Calculus Made Easy. [Book Review]—Turney. (*See* 2831.)

621.38.012 **2724**
Drafting for Electronics. [Book Review]—L. F. B. Carini. McGraw Hill Publishing Co., London, 211 pp., 12s. 6d. (*Elect. Rev., Lond.*, 11th April 1947, Vol. 140, No. 3620, p. 586.) Deals essentially with the production of circuit diagrams for radio receivers and transmitters, c.r. tubes and the various industrial applications of electronics.

GENERAL PHYSICS

53 " 1946 " **2725**
Physics in 1946.—P. Morrison. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 133–152.) A review of various experiments and techniques in the fields of superconductivity, microwaves, atomic physics and atomic energy.

530.145 **2726**
On the Nonlinear Wave Equations of the Quantum Theory of the Electron.—B. Kwal. (*C. R. Acad. Sci., Paris*, 14th April 1947, Vol. 224, No. 15, pp. 1099–1100.)

531.18 : 531.15 **2727**
Is Rotation Relative or Absolute ?—G. Stedman. (*Wireless Engr*, May 1947, Vol. 24, No. 284, p. 156.) Comment on 1727 of June.

534.13 **2728**
The Vibrations of Certain Coupled Systems.—T. Vogel. (*Rev. sci., Paris*, 15th Nov. 1946, Vol. 84, No. 3261, pp. 515–522.) If each degree of freedom of a system S_1 is coupled to one and only one degree of freedom of a system S_2 and conversely, the coupling between S_1 and S_2 is termed monovalent. The theory of such systems is given and applied to the case of a rectangular window, formed by two parallel plates, in an infinite rigid wall. The equations of motion are solved and expressions found for the natural frequencies and for the transparency of the combination with loose and with tight coupling. Experiments with plates of aluminium and of rubber, forming a window in one wall of a sound-proof room, confirm the theory.

535.13 : 538.566 **2729**
Refraction between Absorbing Media.—L. Pincherle. (*Nuovo Cim.*, 1st Oct. 1946, Vol. 3, No. 5, pp. 328–337. In Italian, with English summary.) Theory of a plane electromagnetic wave refracted at the plane boundary between two absorbing dielectrics. A discontinuity is found in the reflected and transmitted fields under conditions in which the average flow of energy through the boundary is zero.

535.341 + 621.317.33.011.5] : 537.226.029.64 **2730**
Extension of the Measurements of Dispersion and Absorption by Liquids, to the Region of Centimetric Radio-Electric Waves.—P. Abadie. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 143–149. Discussion, pp. 155–170.)

535.343.32.029.6 : 541.135 **2731**
The Radio-Frequency Absorption Spectra of Solutions of Electrolytes.—J. Forman & D. J. Crisp. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 186–193.) The absorption of several binary electrolytes in aqueous solutions of various concentrations was measured at frequencies between 25 and 375 Mc/s.

537.122 : 538.122 **2732**
The Radiation of Fast Electrons in the Magnetic Field.—L. Arzimovich & I. Pomeranchuk. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 4, pp. 267–276.) The spectral and angular distribution is investigated.

537.226 + 621.315.6 + 621.317 **2733**
A General Discussion of Dielectrics.—(*See* 2808.)

537.226 **2734**
Dipolar Interaction.—H. Fröhlich. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 3–7. Discussion, pp. 36–40.)

537.226 **2735**
The Influence of Hindered Molecular Rotation on the Dielectric Polarisation of Polar Liquids.—J. G. Kirkwood. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 7–12. Discussion, pp. 36–40.)

537.226 **2736**
Theory of the Crystalline Field in Solid and Liquid Polar Dielectrics.—E. Bauer & D. Massignon. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 12–15. Discussion, pp. 36–40.)

537.226 **2737**
A Contribution to the Theory of the Internal Electrical Field [in a dielectric].—C. J. F. Böttcher. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 16–19. Discussion, pp. 36–40.)

537.226 **2738**
A Comparison of Debye's and Onsager's Theories of the Dielectric Constants of Concentrated Polar Media.—F. C. Frank. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 19–24. Discussion, pp. 36–40.) " It is concluded that Debye's theory may be inaccurate but Onsager's certainly is. Arguments indicating that Debye's theory is very far wrong are refuted."

537.226 **2739**
Some Mathematical Models representing Polar Molecules in Crystals.—F. C. Frank. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 24–25. Discussion, pp. 36–40.) The discussion predicts a dependence of the degree of dielectric polarization on temperature which agrees to some extent with observation.

537.226 **2740**

Molecular Freedom in Solid Dielectrics.—C. P. Smyth. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 175–180.)

537.226 : 001.8 **2741**

A Note on the Analysis of Dielectric Measurements.—S. Whitehead. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 66–75. Discussion, pp. 75–78.) A survey of dielectric theory in its bearing on research.

537.226.2 **2742**

The Dielectric Relaxation of Mixtures of Dipolar Liquids.—A. Schallamach. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 180–186. Discussion, pp. 193–194.)

537.226.2 : 538.569 **2743**

On the Frequency Dependence of the Dielectric Constant in Dipolar Solids.—R. A. Sack. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 61–66. Discussion, pp. 75–78.) An extension to variable fields of the work of Ising (*Z. Phys.*, 1925, Vol. 31, pp. 253–258), who used Debye's original theory based on the Clausius-Mosotti assumption of the internal field.

537.226.8 **2744**

Note on the Comparison of Entropy and Energy Changes in Diffusion and Dielectric Relaxation Processes.—D. L. Levi. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 152–155. Discussion, pp. 155–170.)

537.291 **2745**

Exchange of Energy between an Electron Beam and an Electromagnetic Field of Feeble Intensity.—Guénard. (*See* 2969.)

537.313 **2746**

On the Probability of Electron Conduction Motions.—C. Budeanu. (*C. R. Acad. Sci., Paris*, 9th April 1947, Vol. 224, No. 14, pp. 1054–1056.) Consideration of the probability that an electron at the junction of two resistors will traverse either of them leads approximately to Kirchhoff's law if a sufficiently great time is considered.

537.525 : 538.551.25 **2747**

On the Theory of Electron-Plasma Oscillations.—F. Borgnis. (*Helv. phys. Acta*, 30th April 1947, Vol. 20, No. 2, pp. 207–221. In German.) The theory of short-wave electron oscillations in a gas-discharge plasma is generalized. The treatment of the plane problem by Langmuir & Tonks (1929 Abstracts, p. 273) must be extended to account for the occurrence of independent stationary oscillations in a plasma. The frequency of such oscillations, which can be excited between the limits of the discharge path, is not, in general, identical with the Langmuir frequency.

537.525 : 539.16.08 **2748**

Development of the Discharge in Counter Tubes with Alcohol Vapour.—F. Alder, E. Baldinger, P. Huber & F. Metzger. (*Helv. phys. Acta*, 15th Feb. 1947, Vol. 20, No. 1, pp. 73–95. In German.) The velocity of spreading of the discharge in a tube with 64 mm Hg argon and 16 mm Hg alcohol vapour and a potential of 1 100 V was 8.35×10^6 cm/sec. With a given pressure ratio of alcohol to argon, the velocity increases almost linearly with the potential. With constant potential, the velocity decreases if this pressure ratio is increased.

537.525.72 **2749**

Low-Pressure Electrical Discharges.—E. W. B. Gill & A. von Engel. (*Nature, Lond.*, 22nd March 1947, Vol. 159, No. 4038, pp. 404–405.) High frequency discharges in a glass bulb can be initiated with low uniform gradients if the pressure is of the order of 0.01 to 0.001 mm Hg. Maximum wavelength in metres is about four times the diameter of the bulb in centimetres ; starting potential is independent of the nature of the gas.

537.533.8 : 546.3 **2750**

Rediffused Component of Secondary Electron Emission of Metals.—P. Palluel. (*C. R. Acad. Sci., Paris*, 28th May 1947, Vol. 224, No. 21, pp. 1492–1494.) As the primary velocity increases, the coefficient of rediffusion (or non-elastic reflection) for all the metals considered approaches asymptotically a constant value which increases with atomic number and is reached at lower primary velocities for the lighter metals.

538 122 **2751**

The Lines of Force through Neutral Points in a Magnetic Field.—D. Owen. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 14–18.) Continuation of 3405 of 1945. A method is given for drawing the lines of force, and the field near a neutral point is considered geometrically.

538.2 : 621.365.5 **2752**

Theory of the Heating of Ferromagnetic Materials by Eddy Currents and by Hysteresis.—M. Jouguet. (*Onde élect.*, April 1947, Vol. 27, No. 241, pp. 138–151.) General equations are developed for the case of a solid of revolution, without hysteresis or saturation. The effects of hysteresis and magnetizing field are then considered and formulae derived for the power dissipated by eddy currents and by hysteresis and for the total power dissipation. Discussion shows that hysteresis reduces the eddy current heating but increases the total heating. The results are applied to the induction furnace ; a form factor is introduced and current penetration and skin thickness are discussed. Hysteresis increases the skin thickness but reduces the penetration depth. The choice of the optimum frequency depends on the permeability of the material. The power absorption of an infinitely long cylinder is compared with that of a sphere ; the case of an ellipsoid is also considered.

538.311 + 621.316.97].083 : 621.385.833 **2753**

Measurement of Feeble Magnetic Fields and of the Effects of Shielding. Application to the Electron Microscope.—D. Charles. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 75–77.) The method uses a small coil connected by a screened lead to an amplifier with a voltage gain of about 1 000 for frequencies from 50 to 1 000 c/s. Results are given showing the effect of single and of double cylindrical shields, with and without side holes. The results have been applied to the design of efficient shields for the C.S.F. electron microscope to eliminate the effects of parasitic fields.

538.312 **2754**

Electromagnetic Radiation.—J. Greig. (*Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 143–144.) On the assumption of a finite velocity of propagation of electric and magnetic fields, the main phenomena of electromagnetic radiation can be simply explained.

538.313 + 538.691 **2755**

The Helical Motion of Particles in a Constant Uniform Magnetic Field.—F. Ehrenhaft. (*C. R. Acad. Sci., Paris,* 21st April 1947, Vol. 224, No. 16, pp. 1151–1152.) Particles of Fe, Ni, Mn, Cr, Sb, etc., describe helical paths between the poles of an electromagnet. Photographs are given.

538.56 : 535.13 **2756**

The Reflection of an Electromagnetic Plane Wave by an Infinite Set of Plates : Part 1.—J. F. Carlson & A. E. Heins. (*Quart. appl. Math.,* Jan. 1947, Vol. 4, No. 4, pp. 313–329.) This problem may be formulated as a single inhomogeneous Wiener-Hopf integral equation, and as such it may be solved rigorously using the method of Fourier transformation. The functional form of the various surface current densities, as well as the electric field, is determined. It is shown how some of the results obtained may be interpreted in a simple physical manner, and the relation to ordinary grating theory is pointed out.

538.569.4.029.64 **2757**

Thermal and Acoustic Effects attending Absorption of Microwaves by Gases.—W. D. Hershberger, E. T. Bush & G. W. Leck. (*RCA Rev.,* Sept. 1946, Vol. 7, No. 3, pp. 422–431.) 15 substances, gaseous at normal temperature and pressure, strongly absorb microwaves, the absorbed energy appearing as heat or sound. Methods of measurement are described and the results are tabulated and discussed.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 : 621.396.822
551.510.535
551.594.6 **2758**

Reports on the International Conference of U.R.S.I. (International Radio-Scientific Union).—Y. Rocard. (*Rev. sci., Paris,* 1st Nov. 1946, Vol. 84, No. 3260, pp. 500–501.)

(*a*) Ionosphere. M. Nicolet discusses the formation of the various regions, and criticizes the conclusions of Kiepenheuer (*Annales d'Astrophysique,* 1945, Vol. 8, p. 210).

(*b*) Extraterrestrial electromagnetic noise. Work referred to in 323 of 1946 (Appleton), 1825 of 1946 (Hey : Stratton), and 3599 of 1946 (Hey, Parsons, & Phillips) is considered : see also 402 of February (Appleton).

(*c*) Atmospherics. Discussion of the work of F. A. Berson & S. Petterssen on the geographic distribution in winter of the disturbance centres and their relation to air mass and front distribution. Summer conditions, which were studied by C. K. M. Douglas, are much more complex, and it is difficult to draw definite conclusions from them.

523.323 : 621.396.812 **2759**

Effect of the Moon on Radio Wave Propagation.—(*See* 2903.)

523.746 "1947.03" **2760**

A Giant Sunspot.—(*Nature, Lond.,* 22nd March 1947, Vol. 159, No. 4038, p. 396.) The sunspot group of March 3–17, 1947, was unusually large but was not accompanied by exceptional geomagnetic disturbances.

523.78 "1946.11.23" : 621.396.822.029.63 **2761**

Micro-Wave Solar Noise Observations during the Partial Eclipse of November 23, 1946.—A. E. Covington. (*Nature, Lond.,* 22nd March 1947, Vol. 159, No. 4038, pp. 405–406.) Results on 2 800 Mc/s from Ottawa, Canada ; equivalent temperature of noise-generating region (2.2% of projected area and containing sunspot group) is 1.5×10^6 °K in excess of the average surface temperature of 5.6×10^4 °K.

537.591 **2762**

Non-Primary Cosmic-Ray Electrons above the Earth's Atmosphere.—G. J. Perlow & J. D. Shipman, Jr. (*Phys. Rev.,* 1st March 1947, Vol. 71, No. 5, pp. 325–326.) Summary of data obtained from a V-2 rocket experiment on the presence of electrons of energy $< 5 \times 10^8$ eV above the earth's atmosphere.

537.591 **2763**

Highly Ionizing Particles in the Cosmic Radiation.—V. Veksler, N. Dobrotin & V. Khvoles. (*J. Phys., U.S.S.R.,* 1945, Vol. 9, No. 4, pp. 277–279.)

537.591.15 **2764**

Presence of a Penetrating Component in Extensive Showers in the Atmosphere.—A. Mura, G. Salvini & G. Tagliaferri. (*Nature, Lond.,* 15th March 1947, Vol. 159, No. 4037, pp. 367–369.) Confirmation by an improved experimental technique.

537.591.15 **2765**

The Lateral Extension of Auger Showers.—D. V. Skobeltzyn, G. T. Zatsepin & V. V. Miller. (*Phys. Rev.,* 1st March 1947, Vol. 71, No. 5, pp. 315–317.)

537.591.15 **2766**

Cosmic-Ray Bursts in an Unshielded Chamber and under One Inch of Lead at Different Altitudes.—H. Bridge & B. Rossi. (*Phys. Rev.,* 15th March 1947, Vol. 71, No. 6, pp. 379–380.)

538.71(479.22) **2767**

100 Years of Magnetic Observations at Tbilis [Tiflis].—M. Z. Nodia. (*Viestnik Akad. Nauk, S.S.S.R.,* 1946, No. 7, pp. 47–53. In Russian.)

550.384.3(68) **2768**

The Earth's Magnetic Field in Southern Africa at the Epoch, 1 July 1930.—E. N. Grindley. (*Philos. Trans.,* 29th April 1947, Vol. 240, No. 818, pp. 251–294.) Analysis of a large number of observations to determine the secular variation in the magnetic intensity, declination and inclination. Probable ' normal ' values are shown by maps with isomagnetic lines.

551.510.52 : 621.396.812.029.64 **2769**

Radar Reflections from the Lower Atmosphere.—H. T. Friis. (*Proc. Inst. Radio Engrs, W. & E.,* May 1947, Vol. 35, No. 5, pp. 494–495.) Using a 3-cm radar transmitter and a double-detection receiver, each with a shielded-lens aerial pointing upwards, echoes apparently from stratifications in the lower atmosphere have been received on clear, calm nights. During the day and on windy nights such echoes are usually unobtainable.

551.510.535 **2770**

Note on the [extent and density of the] **Sporadic-E Layer.**—O. P. Ferrell. (*Proc. Inst. Radio Engrs, W. & E.,* May 1947, Vol. 35, No. 5, pp. 493–494.)

551.510.535 : 551.506.2(51) **2771**

Ionosphere Reflections and Weather Forecasting for Eastern China.—E. Gherzi. (*Bull. Amer. met. Soc.*, March 1946, Vol. 27, No. 3, pp. 114–116.) Day-time investigations at Zi Ka Wei observatory, using 20-W aerial power on a frequency of 6 Mc/s, show that when the Pacific trade-wind is dominating the weather, E-layer reflections are obtained. When the Siberian air mass is predominant, reflections come from the F layer. In general, F_2-layer reflections are found when tropical air is predominant. With approaching typhoons, the E-layer echo becomes very strong. It is suggested that similar effects might be observed in the eastern parts of the U.S.A.

551.510.535 : 621.396.11 **2772**

The Application of Ionospheric Data to Radio Communication Problems : Part 2.—Appleton & Beynon. (*See* 2895.)

551.510.535 : 621.396.11 **2773**

Oblique Radio Transmission in the Ionosphere, and the Lorentz Polarisation Term.—Beynon. (*See* 2896.)

551.510.535 : 621.396.6 **2774**

Ionosphere Equipment for Field Use.—Musselman. (*See* 2929.)

551.57 : 621.396.82 : 629.135
551.57 : 621.319.74 : 629.135 **2775**

Electrostatic Ills and Cures of Aircraft : Parts 1 & 2.—Beach. (*See* 2916.)

551.593.9(54) **2776**

Measurement of the Intensity of the Night Sky Light at Calcutta.—S. N. Ghosh. (*Indian J. Phys.*, Dec. 1946, Vol. 20, No. 6, pp. 205–213.) Measurements on 50 nights during 1943–1945 show that on undisturbed nights the intensity decreased to a minimum about local midnight and then increased. On disturbed nights accompanied by magnetic disturbance the intensity variation followed generally that of maximum ionization of the F region. Other nights, when the night sky intensity varied abnormally but did not follow the electron density of the F region, were free from magnetic disturbance.

LOCATION AND AIDS TO NAVIGATION

534.88 **2777**

Sonar — The Submarine's Nemesis.—C. G. McProud. (*Radio News*, March 1947, Vol. 37, No. 3, pp. 47–49..141.) Describes, with photographs and block diagrams, the R.C.A. QCQ-2 and the Submarine Signal Co.'s WCA-2 equipments and their operational principles. See also 1750 and 3605 of 1946.

621.396.674 : 621.396.62 **2778**

A Portable Direction Finding Receiver.—J. M. S. Watson. (*R.S.G.B. Bull.*, April 1947, Vol. 22, No. 10, pp. 161–164.) Equipment for operation in the 1.7-Mc/s band.

621.396.93 : 551.594.6 **2779**

The Location of Thunderstorms by Radio Direction-Finding.—F. Adcock & C. Clarke. (*J. Inst. elect. Engrs*, Part III, March 1947, Vol. 94, No. 28, pp. 118–125. Discussion, pp. 133–140.) Polarization error due to the presence of ionospheric reflections is the main source of inaccuracy in the crossed-loop cathode-ray direction finders now used. Various systems (including time-delay methods) for improving the accuracy of location are considered and compared. Details are given of an experimental 10–30-kc/s twin-channel cathode-ray direction finder, using brilliance modulation to eliminate ionospheric components of the lightning pulse and errors due to overloading ; this direction finder has crossed-loop aerials but may be adapted for the spaced-loop or Adcock types. A summary was noted in 2126 of July ; see also 1786 of June.

621.396.93 : 621.396.677 **2780**

The Development and Study of a Practical Spaced-Loop Radio Direction-Finder for High Frequencies.—W. Ross. (*J. Instn elect. Engrs*, Part III, March 1947, Vol. 94, No. 28, pp. 99–107. Discussion, pp. 133–140.) The instrument is of the rotating type and uses two single-turn 1-m square vertical coaxial screened loops 3 m apart. The field strength required for an arc of silence of $\pm 5°$ varies from 1.5 μV/m to 4 μV/m for a vertically polarized ground wave between 3 and 15 Mc/s. The instrument is particularly useful for taking bearings on steeply incident ionospheric waves, where Adcock direction-finders are very inaccurate. The polarization error which may be introduced by the essentially non-uniform current distribution along loops is analysed and discussed. Examples of site errors reducing the accuracy of the instrument are given. See also 2783 below.

621.396.93 : 621.396.677 **2781**

The Use of Earth Mats to reduce the Polarization Error of U-Type Adcock Direction-Finders.—R. L. Smith-Rose & W. Ross. (*J. Instn elect. Engrs*, Part III, March 1947, Vol. 94, No. 28, pp. 91–98. Discussion, pp. 133–140.) Polarization errors introduced by the buried horizontal feeders of a four-aerial U-type Adcock direction-finder were found to be greatly reduced between 3 and 10 Mc/s by an earthed wire mat of 0.6-m square mesh 31 m in diameter (about five times the aerial spacing) laid symmetrically around the aerial system on or near the ground. Earthing the mat was found to be essential ; on high-conductivity ground direct earth connections could be used, but on low-conductivity ground it was necessary to connect sets of radial wire extensions of various lengths to the mat, each set resonating roughly independently of the others to provide a low-impedance path to earth for the periphery of the mat at various frequencies between 3 and 10 Mc/s. Provided that the feeders were not too large in diameter, and were bonded to the mat, it was found unnecessary to bury them. The polarization error, besides being considerably reduced, should be more independent of weather conditions and therefore more accurately predictable.

621.396.93 : 621.396.677.029.58 **2782**

Site and Path Errors in Short-Wave Direction-Finding.—W. Ross. (*J. Instn elect. Engrs*, Part III, March 1947, Vol. 94, No. 28, pp. 108–114. Discussion, pp. 133–140.) Measurements made with four-aerial Adcock and portable rotating H-type direction-finders on sites chosen by visual inspection as good (i.e. flat and open over at least 1 km²) showed that the site and/or path errors varied with the transmitter bearing, frequency (6–15 Mc/s) and distance (50–600 m and 3–16 km) in an entirely random manner through ± 3° and more for the distant transmitters. Ground-wave propagation was assumed throughout. Explanations are given, and it is concluded that a local calibration for supplying a detailed correction curve to observed bearings is not, in general, possible in the short-wave band, but may still be useful when assessing the overall reliability of a particular installation.

621.396.93 : 621.396.677.029.62 **2783**

An Experimental Spaced-Loop Direction-Finder for Very High Frequencies.—F. Horner. (*J. Instn elect. Engrs*, Part III, March 1947, Vol. 94, No. 28, pp. 126–133. Discussion, pp. 133–140.) This direction-finder uses two single-turn 28-cm square vertical coaxial screened loops 157 cm apart, and the field strength required for an arc of silence of ± 5° is 20 μV/m for a vertically polarized ground wave between 30 and 100 Mc/s. For high-angle waves (e.g. from aircraft) it appears to be more accurate than the rotating-H Adcock type provided that care is taken to eliminate errors due to loop resonances. A similar instrument using 92-cm loops 220 cm apart to give increased sensitivity (4 μV/m) at 30 Mc/s is described briefly. The polarization error introduced by calibrating with an elevated transmitter so close that the wave from it has appreciable curvature is evaluated and discussed. See also 2780 above.

621.396.93 : 621.396.677.029.63 **2784**

Some Experiments on Conducting Screens for a U-Type Spaced-Aerial Radio Direction-Finder in the Frequency Range 600-1 200 Mc/s.—R. R. Pearce. (*J. Instn elect. Engrs*, Part III, March 1947, Vol. 94, No. 28, pp. 115–117. Discussion, pp. 133–140.) A simple direction-finder was used to investigate the effect of large earth screens. A metal plate (or a $\lambda/12$ mesh of wire) not less than 4λ in diameter was required to reduce the polarization error of the direction-finder to about 1°.

621.396.96 : 535.37 **2785**

Luminescence and Tenebrescence as Applied in Radar.—Leverenz. (*See* 2796.)

621.396.96 : 621.385.832 **2786**

A Survey of Cathode-Ray-Tube Problems in Service Applications, with Special Reference to Radar.—Bradfield, Bartlett & Watson. (*See* 2984.)

621.396.96 : 621.385.832 **2787**

War-Time Developments in Cathode-Ray Tubes for Radar.—Jesty, Moss & Puleston. (*See* 2983.)

621.396.96 : 621.396.1 **2788**

Radar Allocations.—J. Markus. (*Electronics*, May 1947, Vol. 20, No. 5, p. 150.) A note on the allocation of the frequency bands 3 000–3 246 Mc/s, 9 320–9 500 Mc/s and 5 460–5 650 Mc/s for ship-borne radar by the Federal Communications Commission.

621.396.96 : 621.396.812 **2789**

A Theory of the Performance of Radar on Ship Targets.—Wilkes & Ramsay. (*See* 2904.)

621.396.96 : 621.396.82 **2790**

The War in the Ether.—E. B. Addison. (*J. R. aero. Soc.*, May 1947, Vol. 51, No. 437, pp. 425–436. Discussion, pp. 436–439.) A lecture dealing mainly with the use of radio as a weapon, and the tactics evolved to use it in the defence of Britain and in the protection of our bombers when attacking targets in enemy territory.

621.396.96.029.64 : 531.55 **2791**

Centimetre Radar for Precision Gun-Laying.—H. A. M. Clark. (*Proc. R.S.G.B.*, Spring 1947, No. 1, pp. 7..15.) Discussion of applications of radar to naval gunnery with emphasis on close range sets. A 3-cm auto-following set of this type is described in some detail.

621.396.96 **2792**

Principles of Radar. [Book Review]—Staff of Radar School, Massachusetts Institute of Technology. McGraw-Hill Publishing Co., London, 2nd edn, 25s. (*Wireless Engr*, May 1947, Vol. 24, No. 284, p. 155.) " It deals with each aspect of the whole wide field of radar with equal thoroughness and specialized knowledge, while achieving a remarkable consistency of treatment and organic unity."

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 : 539.163.2.08 : 620.191.33 **2793**

High Vacuum Leak Testing with the Mass Spectrometer.—W. G. Worcester & E. G. Doughty. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 946–955. Discussion, p. 1170.) See also 2441 of August.

533.5 : 539.163.2.08 : 620.191.33 **2794**

Spectrometer Vacuum Leak Detector.—G. A. Doxey. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 142..194.) Cracks are detected in high vacuum systems by measuring leakage of helium into the system with a mass spectrometer. See also 2441 of August.

535.37 **2795**

Luminescent Materials.—S. György. (*Elektrotechnika, Budapest*, April & May 1947, Vol. 39, Nos. 4 & 5, pp. 70–73 & 81–86. In Hungarian, with English, French and German summaries.) A review of the more important luminescent materials, with an account of investigations by the author and E. Nagy of the band structure and temperature dependence of the luminescence of manganese-activated zinc silicate and zinc-beryllium silicate phosphors. A relation is found between the temperature dependence of the luminescence and that of the electrical conductivity.

535.37 : 621.396.96 **2796**

Luminescence and Tenebrescence [i.e., opposite of luminescence] **as Applied in Radar.**—H. W. Leverenz. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 199–239.) A comprehensive description of the properties of phosphors and 'scotophors' [i.e., opposite of phosphors] developed during the war for delay screens for cathode-ray tubes. Examples of typical radar displays are given; operating voltages were usually limited to 5 kV and trace persistences were required up to 30 sec. The energy imparted per signal pulse for typical p.p.i. operation is calculated for different screens and radar images are discussed in relation to the properties of the human eye. Methods are listed for converting cathode rays into visible radiation; only cathodo-luminescence and cathodo-tenebrescence have found practical application in radar. Ideal and real performances of phosphors and 'scotophors' are contrasted and an idealized picture given of the mechanism of luminescence and tenebrescence.

Cascade screens comprising stratified layers of different phosphors which give an increase in phosphorescence and a decrease in initial luminescence largely overcome the difficulty of low penetration of the cathode rays due to the 5-kV voltage limitation. They are operated at low luminescence by using the enhanced sensitivity of the dark-adapted human eye.

Long persistent images were produced having dark traces on a bright field using (*a*) negative modulation of luminescence ('c.r. burn' method) and (*b*) tenebrescent screens of 'scotophors'.

Tabular summaries of some of the more useful c.r.t. screens are given as an aid to radar indicator designers and there is an extensive bibliography.

535·377 **2797**

The Thermoluminescence and Conductivity of Phosphors.—R. C. Herman & C. F. Meyer. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 258–259.) Correction and addendum to 743 of March.

537.226.8 **2798**

Power Factor and Temperature Coefficient of Solid (Amorphous) Dielectrics.—M. Gevers & F. K. du Pré. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 47–55. Discussion, pp. 75–78.) In amorphous dielectrics, including those consisting of a crystalline mass containing many lattice irregularities and impurities, the dielectric constant and the power factor are, in general, almost independent of frequency and the ratio of the temperature coefficient of the dielectric constant to the power factor is nearly constant. An explanation of these properties is based on the peculiar structure of such solids.

537.226.8 **2799**

The Distribution of Relaxation Times in Dielectrics.—C. G. Garton. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 56–60. Discussion, pp. 75–78.) The variation of loss angle with frequency in dielectrics is explained by the existence of a distribution of relaxation times due to the presence of elements—dipoles or ions—which oscillate between 'wells' of varying potential depth whose distribution is determined by considerations of temperature and viscosity.

537.228.1 **2800**

Effect of Foreign Ions on the Properties of Rochelle-Type Crystals.—B. Matthias & W. Merz. (*Helv. phys. Acta*, 31st July 1946, Vol. 19, No. 4, pp. 227–229. In German.) All Rochelle-type crystals have a maximum in the resonance-frequency/temperature curve at a point about 80° K above the Curie temperature. Addition of Tl to KH_2PO_4 raises both the maximum and the Curie temperature by an amount approximately proportional to the Tl concentration. The alkali ions produce the opposite effect.

537·533 :[546.26-1 + 546.28 **2801**

Measurement of the Thermo-Electron Emission from Graphite, Silicon and Silicon Carbide.—A. Braun & G. Busch. (*Helv. phys. Acta*, 15th Feb. 1947, Vol. 20, No. 1, pp. 33–66. In German.) A new method was used, the inner wall of the heating chamber serving as anode for the emitted electrons. For graphite the constants in the emission formula $I = AT^2 e^{-\phi/KT}$ were found to be $\phi = 4{\cdot}39$ eV, $A = 15$ A/cm² (°K)². The corresponding values for silicon were 3·59 eV and 8 A/cm² (°K)². The results for single crystals of silicon carbide varied widely depending on the surface layer. The results are shown graphically.

538.221 **2802**

A New Magnetic Material of High Permeability.—O. L. Boothby & R. M. Bozorth. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 173–176.) A description of the preparation, heat treatment, and properties of 'supermalloy', a magnetic alloy of iron, nickel, and molybdenum. As 0.001-inch insulated tape in transformer cores, it has an initial permeability of 50 000–120 000, and permits a three-fold increase in the frequency range transmitted.

538.221 : 621.317.41.029.63 **2803**

A Method to Measure Complex Permeabilities of Metals at U.H.F.—Johnson, Rado & Maloof. (*See* 2852.)

538.23 : 669.157.82 **2804**

Demagnetizing Coefficients and Hysteresis Losses of Rectangular Iron-Silicon Strips.—E. H. Sondheimer. (*Proc. Camb. phil. Soc.*, April 1947, Vol. 43, Part 2, pp. 254–261.) Investigation of the variation of the demagnetization coefficient N with the dimensions of the specimen and its intensity of magnetization. Hysteresis loss is approximately independent of N.

546.431.821 : 548.3 **2805**

Crystal Structure of Barium Titanium Oxide and Other Double Oxides of the Perovskite Type.—H. D. Megaw. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 224–231.) Compounds of the perovskite type having the empirical formula $A^{2+}B^{4}+O_3$ show distortion from the ideal structure, depending on the size of the A^{2+} cation.

546.431.821 : 621.315.611.011.5 **2806**

The Permittivity of Polycrystals of the Perovskite Type.—D. F. Rushman & M. A. Strivens. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 231–238.) The main features of the dielectric polarization phenomena occurring in barium titanate and the mixed Ba/Pb/Sr titanates are discussed. The behaviour of these compounds can be explained by a displacement of the equilibrium position of the titanium ion in the crystal structure.

62"1946" **2807**

Progress in Engineering Knowledge during 1946.—Alger, Stokley, Faust, Robinson, Tugman, Kuyper & Haylon. (*See* 2996.)

621.315.6 + 537.226 + 621.317 **2808**

A General Discussion on Dielectrics.—(*Trans. Faraday Soc.*, 1946, Vol. 42A.) A special number incorporating papers and discussions at the conference at Bristol University, 24th–26th April 1946. For abstracts of selected individual papers, see Materials, General Physics and Measurements sections.

621.315.611.015.5 + 537.529 **2809**

Electric Breakdown of Solid Dielectrics.—A. von Hippel. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 78–87. Discussion, pp. 87–90.) The experimental facts are described for both crystalline and amorphous solids and the theory is propounded that excess electrons, accelerated in the applied field, produce impact ionization, avalanche formation and breakdown. In the author's opinion, in the absence of an applied field these electrons are stopped by a friction barrier of lattice vibrations in the material. In the discussion various alternative theories are put forward.

621.315.612.015.5 **2810**

The Electrical Performance of Ceramic Dielectrics at Elevated Temperatures.—H. A. Frey & J. M. Jesatko. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 911–920. Discussion, pp. 1126–1128.) Data on the variation of resistivity with temperature of porcelain, steatite, glass and zircon compositions ; the effect of voltage gradient is also stated and a method given for determining approximately the conditions for breakdown.

621.315.612.3.029.5 **2811**

Steatite for High Frequency Insulation.—J. M. Gleason. (*Proc. Instn Radio Engrs, Aust.*, April 1945, Vol. 5, No. 8, pp. 2–12.) A detailed account of the physical and electrical properties of steatite and steatitic ceramics, with a short discussion of production methods and insulator design.

621.315.616.9.011.5 + 541.64 **2812**

The Dielectric Properties of High Polymers.—R. B. Richards. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 194–197.)

621.315.616.9.011.5.029.5 **2813**

The Dielectric Properties of Chlorinated Polythenes at Radio Frequencies.—W. G. Oakes & R. B. Richards. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 197–205.) Measurements over the range 10^4–10^8 c/s. Increase of the average dipole orientation relaxation time with increase of chlorine content is in accord with the change from a flexible or rubbery to a rigid state.

621.315.616.9.011.5.029.5 **2814**

Dipole Orientation in Solutions of Esters in Polyisobutene and Polythene.—K. W. Plessner & R. B. Richards. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 206–213.) Power factor/frequency curves are given for the range 10^4–10^8 c/s and are discussed with reference to relaxation times and dipole orientation.

621.315.616.9.029.5 **2815**

Dielectric Dispersion and Absorption in Natural Rubber, Neoprene, Butaprene NM and Butaprene S, Gum, and Tread Stocks.—W. C. Carter, M. Magat, W. C. Schneider & C. P. Smyth. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 213–220.) The dielectric constants of various elastomers, gums and treads were measured over a wide range of frequency. The results obtained show reasonable agreement with predictions from the Fuoss-Kirkwood theory. The abnormally high losses of tread stocks are due to a superposition of Debye effect, Maxwell-Wagner effect and d.c. conductance.

621.318.323.2.042.15 **2816**

Iron-Dust Cores.—G. H. M. Gleadle. (*Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 156–157.) Results are given of measurements on Ferrocart rings. See also 1692 and 1693 of June.

621.396.611.21 + 537.228.1 **2817**

Quartz Oscillators.—Vigoureux. (*See* 2703.)

621.775.7 : 621.396 **2818**

Powder Metallurgy and Its Application to Radio Engineering.—N. Fetherston & L. W. Cranch. (*Proc. Instn Radio Engrs, Aust.*, May 1945, Vol. 5, No. 9, pp. 3–14.) Applications of powder metallurgy include the production of self-lubricating bearings, porous metal filters, Alnico permanent magnets, tungsten rods for wire drawing, silver-graphite and silver-tungsten contacts, iron-dust cores, etc. The methods used for obtaining powdered copper and iron are described and also sintering processes and the manufacture of iron-dust cores. The selection of the grade of magnetic material best suited for a specified frequency application is discussed and practical applications of iron-dust cores of various types are given.

666.1 : 621.385 **2819**

Glass in the Radio Industry.—F. Violet, A. Danzin & A. Commin. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 24–74.) An account of the development of glass technique in valve manufacture, showing how research on glass composition, expansion coefficients, the physics of glass-to-metal seals, etc., has led to a progressive replacement of empirical by scientific processes. A detailed description is given of modern mass-production methods of manufacture of valve feet with projecting pins.

669.152.5 **2820**

New Magnetic Alloy.—(*Elect. Times*, 17th April 1947, Vol. 111, No. 2893, p. 437.) 'Hiperco', consisting of 35% cobalt, 64% iron and 1% chromium gives the highest saturation point of any magnetic material yet known.

669.198.1 : 669.5 **2821**

A New Zinc-Base Finish for Steel Parts.—J. A. Williams. (*Materials & Methods*, March 1947, Vol. 25, No. 3, pp. 95–96.) Method of zinc plating, which gives a hard, long-wearing surface with the appearance of chromium plating and has greater corrosion resistance than tin finishes formerly used.

669.45.778 : 621.315.22 **2822**

F_3 Lead Alloy—An Improved Cable Sheathing.—L. F. Hickernell & C. J. Snyder. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1136–1141.) Discussion on 3647 of 1946.

621.318.22 : 669 **2823**

Magnet Steels and High Performance Magnet Alloys. [Book Review]—W. Jessop & Sons, Sheffield. (*Overseas Engr*, March 1947, Vol. 20, No. 234, p. 278.) Gives information on metallurgical aspects of the manufacture of permanent magnets, with a résumé of the theory of magnetization, demagnetization and artificial aging. The properties and treatment of various alloys are tabulated.

679.5 **2824**

Plastics for Production. [Book Review]—P. I. Smith. Chapman & Hall, London, 2nd edn, 216 pp., 15s. (*Beama J.*, Feb. 1947, Vol. 54, No. 116, pp. 73–76 ; *Elect. Rev., Lond.*, 11th April 1947, Vol. 140, No. 3620, p. 586.)

MATHEMATICS

517.512.2 : 621.396.67 **2825**

Fourier Transforms in Aerial Theory : Part 1.—Ramsay. (*See* 2680.)

518.2 **2826**

Table of the Integral $(2/\pi)\int_0^x(1/t)\tanh^{-1}t\,dt$.—M. S. Corrington. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 432–437.) A 5-figure table for the range $x = 0$ to 1, with detailed explanation of the methods of computation and checking.

518.5 **2827**

Analysis of Problems in Dynamics by Electronic Circuits.—J. R. Ragazzini, R. H. Randall & F. A. Russell. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 444–452.) A method of solving integro-differential equations of physical systems by the use of an electronic system, the basic component of which is a stabilized feedback amplifier which, by external changes in connections, may be used as integrator, differentiator or sign changer.

The application of such amplifiers in systems for the solution of linear first-degree equations, simultaneous integro-differential equations and equations with variable coefficients is considered.

518.5 **2828**

Mercury Memory Tanks in New EDVAC [electronic discrete variable] **Computer.**—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 168..176.) A tube containing mercury has an X-cut quartz crystal at each end in intimate contact with the mercury. Electrical pulses, spaced 1 μs apart, are converted by one crystal into ultrasonic pulses which travel relatively slowly through the mercury. These are reconverted to electrical pulses by the second crystal, amplified and fed back into the first crystal producing a closed cycle of stored pulses. Multiple electronic switch or gate circuits introduce or withdraw any pulse as required so that a low-loss storage device is provided capable of storing eight 10-digit numbers and referring to any one in an average time of 200 μs.

519.28 : 52/59 **2829**

Choice of a ' Reality Index ' for Suspected Cyclic Variations.—W. O. Kermack : W. Gleissberg. (*Nature, Lond.*, 1st March 1947, Vol. 159, No. 4035, pp. 305–306.) A criticism of Gleissberg's application of his ' reality index ' to data concerning sunspot maxima (1496 of May).

538.566 : 621.396.677.029.64 **2830**

Electromagnetic Fields in a Paraboloidal Reflector.—Pinney. (*See* 2687.)

517.432.1 **2831**

Heaviside's Operational Calculus Made Easy. [Book Review]—T. H. Turney. Chapman & Hall, London, 2nd edn 1947, 102 pp., 10s. 6d. (*Distrib. Elect.*, April 1947, Vol. 19, No. 166, p. 242.) Embodies some additional information and, in some instances, more detailed explanations. For review of first edition see 1253 of 1945.

MEASUREMENTS AND TEST GEAR

621.317 + 621.315.6 + 537.226 **2832**

A General Discussion on Dielectrics.—(*See* 2808.)

621.317.081.3+53.081.3 **2833**

International Committee of Weights and Measures.—(*Nature, Lond.*, 8th March 1947, Vol. 159, No. 4036, pp. 325–326.) Includes a recommendation that absolute electrical units based on the m.k.s. or c.g.s. system should be substituted for the present international electrical units based on the mercury ohm and the silver voltameter. The ratios accepted by the Committee are :

1 mean international ohm = 1.000 49 ohm (absolute)

1 mean international volt = 1.000 34 volt (absolute).

621.317.081.3+53.081.3 **2834**

Absolute Electrical Units.—(*Elect. Rev., Lond.*, 18th July 1947, Vol. 141, No. 3634, p. 94.) In accordance with decisions taken by the International Committee of Weights and Measures (2833 above) the system of electrical units employed at the National Physical Laboratory will be changed on January 1st, 1948, from ' international ' to ' absolute ' units. The conditions to be satisfied for the issue of N.P.L. certificates after this date are stated.

621.317.1 : 621.396.621.029.62 **2835**

The Testing Procedure for F.M. V.H.F. Receivers.—Fanker & Ratcliffe. (*See* 2912.)

621.317.32 : 621.396.81 : 621.396.97 **2836**

BC [broadcasting] **Field Intensity Measurements.**—(*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 64–65.) A portable set covering the frequency range 200–7 000 kc/s in four bands and with an intensity range from 20 μV/m to 10 V/m.

621.317.33 : 621.392.43 **2837**

Impedance Measurement on Transmission Lines.—King. (*See* 2673.)

621.317.33.011.5 + 535.341] : 537.226.029.64 **2838**

Extension of the Measurements of Dispersion and Absorption by Liquids, to the Region of Centimetric Radio-Electric Waves.—Abadie. (*See* 2730.)

621.317.33.011.5 + 535.341] : 537.226.2.029.64 **2839**

Wave Guide Measurements of Dielectric Absorption of Solutions of Polar Substances in Non-Polar Solvents.—H. W. Hall, I. G. Halliday, W. A. Johnson & S. Walker. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 136–143. Discussion, pp. 155–170.) Variation of dielectric absorption with viscosity at 10^{10} c/s.

621.317.33.011.5 + 535.341] : 621.315.615.029.64 **2840**

Some Measurements on the Absorption of Centimetric Waves by Liquid Dielectrics.—F. J. Cripwell & G. B. B. M. Sutherland. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 149–152. Discussion, pp. 155–170.)

621.317.33.011.5+535.341] : [621.315.615.2.029.5/.6 **2841**

Dielectric Absorption in Benzene and Liquid Paraffin Solutions at Ultra High Frequencies.—W. Jackson & J. G. Powles. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 101–108. Discussion, pp. 155–170.) The variation of loss angle with frequency conforms to the original Debye theory. Experimental arrangements are described.

621.317.33.011.5 + 535.341] : 621.315.615.9.029.64 **2842**

Measurements on the Absorption of Microwaves : Parts 1 & 2.—D. H. Whiffen & H. W. Thompson. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 114–129. Discussion, pp. 155–170.) The results of measurements of the absorption of 1.27-cm and 3.26-cm waves and of absorption/temperature variations in a number of liquid hydrocarbons are presented and discussed in relation to relaxation phenomena.

621.317.33.011.5.029.64 : 537.226 **2843**

The Representation of Dielectric Properties and the Principles underlying Their Measurement at Centimetre Wavelengths.—W. Jackson. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 91–101. Discussion, pp. 155–170.) The representation of the electrical properties of dielectric media is explained and resonance methods of measuring them are compared with the standing-wave method. It is stressed that very great care is necessary in the designing of the standing-wave detector system.

621.317.33.011.5.029.64 : 546.212 **2844**

Dielectric Properties of Water.—C. H. Collie, D. M. Ritson & J. B. Hasted. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 129–136. Discussion, pp. 155–170.) Description of the apparatus used in measurements at wavelengths of 10.0 and 1.25 cm, over the temperature range 0°–100°C. Experimental results are given and briefly discussed.

621.317.33.011.5.029.64 : 546.212-16 **2845**

Measurements of the Dielectric Properties of Ice.—J. Lamb. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 238–244.) Measurements were made (*a*) at a frequency of 10^{10} c/s, over the temperature range 0° to -40°C ; and (*b*) at a temperature of -5°C, over the frequency range 8×10^3–1.25×10^6 c/s. The loss-factor/temperature curve for 10^{10} c/s shows a sharp elbow at about -5°C, above which temperature the loss factor increases rapidly. Possible explanations of this are suggested.

621.317.33.011.5.029.64 : 621.315.611 **2846**

Some Measurements of the Permittivity and Power Factor of Low Loss Solids at 25 000 Mc/s Frequency.—R. P. Penrose. (*Trans. Faraday Soc.*, 1946, Vol. 42A, pp. 108–114. Discussion, pp. 155–170.) Dielectric properties were investigated by using a flat circular disk of dielectric inserted at one end of an H_0-mode cylindrical cavity resonator and measuring the consequent variation in resonant length. The derivation of permittivity and power factor is explained and the experimental accuracy discussed.

621.317.333 : 621.319.53 **2847**

A 2½-Million Volt Surge Generator.—(*Engineer, Lond.*, 28th March 1947, Vol. 183, No. 4757, p. 273.) For testing cables and insulating materials.

621.317.333.82 : 620.179.1 : 621.315.2 **2848**

The Henley 1 200 000 Volt Impulse Testing Plant : Part 1—The Basic Principles for Cable Testing.—T. R. P. Harrison. (*Distrib. Elect.*, April 1947, Vol. 19, No. 166, pp. 224–227.) The basic circuit and operation of many stages in cascade are described and waveform control and the effect of the circuit inductance discussed. For voltage measurement a c.r.o. is used with a capacitor-type potential divider.

621.317.361 + 531.761 **2849**

WWV Schedules.—(*Electronics*, May 1947, Vol. 20, No. 5, p. 87.) A summary of the standard frequency transmissions from the National Bureau of Standards, Washington, D.C.

621.317.382.029.6 **2850**

Microwave Power Measurement.—T. Moreno & O. C. Lundstrom. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 514–518.) " Possible methods of microwave power measurement are reviewed. The design requirements for bolometric wattmeters are outlined, and examples are given of bolometer elements that have been developed to meet these requirements. A recently developed bolometer element that may be used over an exceedingly wide band of frequencies is included. The results of experiments to investigate sources of error and to determine the accuracy of these wattmeters are summarized. These experiments indicate that, although serious errors are possible, proper usage will hold errors to within a few per cent."

621.317.39 : 531.76 : 621.3.015.33 **2851**

Pulse Width Measuring Method.—(*Tele-Tech*, April 1947, Vol. 6, No. 4, p. 57.) An instrument with an accuracy of ¼ μs for pulse widths of 3–12 μs independent of repetition frequency.

621.317.41.029.63 : 538.221 **2852**

A Method to Measure Complex Permeabilities of Metals at U.H.F.—M. H. Johnson, G. T. Rado & M. Maloof. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, p. 472.) Summary of Amer. Phys. Soc. paper. The method involves measurement of the changes in Q and in the resonant frequency when a metal is substituted for the ferromagnetic centre conductor in a coaxial resonator.

621.317.72.029.56/.58] : 621.392.43 **2853**

The " Micromatch ".—M. C. Jones & C. Sontheimer. (*QST*, April 1947, Vol. 31, No. 4, pp. 15–20.) A meter for direct measurement of the standing wave ratio of transmission lines and r.f. power. It operates over the frequency range 3–30 Mc/s and for line impedances of 70–300 Ω and, as a power meter at maximum sensitivity, has a full scale deflection corresponding to approximately 10 W or 40 W with a 70-Ω or 300-Ω line respectively.

621.317.733 **2854**

Considerations on the Equations of Balance of an A.C. Wheatstone Bridge.—M. Romanowski & G. Leclerc. (*Rev. gén. Élect.*, March 1947, Vol. 56, No. 3, pp. 129–132.) Discussion of the classical methods for reducing the effects of parasitic capacitance and an account of a method, due to J. Carvallo, of eliminating the effect of the capacitances localized at the corners of the bridge. The case where an intermediate point on one of the arms has appreciable capacitance to earth is also considered.

621.317.75.029.64 **2855**

Microwave Spectrum Analyzers.—H. R. Traver & F. L. Burroughs. (*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 35–38.) Details of sharply tuned superheterodyne receivers whose frequency of reception is made to sweep across the frequency spectrum at a rate slow compared with the pulse repetition frequency of the oscillator being studied. Details are given of an analyser for 9 300 Mc/s using a reflex klystron as local oscillator.

621.317.761.087 **2856**

Direct Frequency Measurement.—L. M. Berman. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 202..208.) Summary of 2504 of August.

621.317.79 : 621.396.611 **2857**

Automatic [circuit] **Testing Machine.**—(*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 144–145.) A short account of the principles and operation of the apparatus described by Williams, Marshall, Bissmire & Crawley (2181 of July).

621.396.615.12 : 621.317.79 **2858**

Standard Frequency Generator.—S. J. Haefner & R. H. Smith. (*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 58–59.) Push-button operation gives frequencies from 40 kc/s to 1 000 kc/s in steps of 40 kc/s. With an interpolation oscillator continuously variable from 10 kc/s to 50 kc/s, any frequency in the above range is obtained.

621.396.615.17 : 621.396.822 **2859**

Noise Signal Generator.—W. P. Dolphin. (*R.S.G.B. Bull.*, April 1947, Vol. 22, No. 10, pp. 158–160.) The noise factor is defined and it is shown that a noise generator gives a true value for the signal-to-noise ratio independent of the bandwidth of the receiver. The generator consists of a saturated diode with a resistive load, the noise output being controlled by varying the filament current. A practical account of the technique for frequencies up to 100 Mc/s is given and other uses of the generator are indicated.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.61-15 : 621.317.755 : 535.33 **2860**

An Infra-Red Spectroscope with Cathode-Ray Presentation.—E. F. Daly & G. B. B. M. Sutherland. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 77–87.) An instrument by means of which a range of 2.5–3.5 μ, anywhere between 1 and 16 μ, can be scanned in 14 seconds. See also 3373 of 1946.

535.61-15 : 621.383.001.8 **2861**

An Infrared Image Tube and Its Military Applications.—G. A. Morton & L. E. Flory. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 385–413.) Description of components of an infra-red electron telescope, comprising image tube, objective for forming infra-red image on photocathode and optical system for viewing reproduced image.

535.61-15 : 621.389 **2862**

Infra-Red Ray Development.—(*Electrician*, 11th April 1947, Vol. 138, No. 3591, pp. 933–934.) British equipment, perfected in 1941, consists fundamentally of a small vacuum container with two flat parallel sides, spaced about 0.5 cm apart, lying at right angles to the axis of a telescope. One side supports a caesium-silver infra-red-sensitive photocathode, while the other is coated with fluorescent material and is electrically conducting. A d.c. potential of 3–4 kV, derived from a small Zamboni pile, is maintained between the photocathode and the anode. Radiation from an infra-red source, after filtering out any visible component, is focused on the photocathode, the electrons from which give an image on the fluorescent screen. With infra-red headlights and binoculars the system was largely used for night driving. The smallest British receiver, a single eyepiece model, weighs only 1¼ lb, compared with 16 lb for the German equivalent. See also 2207 of July.

536.48 **2863**

Possible Use of Thermal Noise for Low Temperature Thermometry.—E. Gerjuoy & A. T. Forrester. (*Phys. Rev.*, 15th March 1947, Vol. 71, No. 6, pp. 375–376.) Further comment on 483 of February: see also 2185 of July. It is shown theoretically that the minimum measurable temperature, under given conditions, is about 2°K.

537.531 **2864**

The Physical Properties of Super-Voltage X Rays.—H. Miller. (*Radiography*, April 1947, Vol. 13, No. 148, pp. 37–41.) A general account, with special reference to voltages ranging up to 20 MV, whose use for X-ray therapy gives promise of valuable new possibilities.

539.16.08 **2865**

Spread of Discharge in Geiger Counters.—J. D. Craggs & A. A. Jaffe. (*Nature, Lond.*, 15th March 1947, Vol. 159, No. 4037, pp. 369–370.)

539.16.08 **2866**

Simplified Spark Counter.—H. Greinacher. (*Helv. phys. Acta*, 30th April 1947, Vol. 20, No. 2, pp. 222–224. In German.) Uses a symmetrical spark gap with small platinum-ball electrodes sealed in a glass bulb. This is connected in series with a 0.5-MΩ resistor shunted by a small capacitor, a neon lamp, a telephone earpiece and the secondary of a transformer giving about 2 200 V. A tube with a thin end is sealed into the glass bulb to allow the counter to be used for α-particles. Telephone clicks, though weak, are quite audible and the glow tube is bright enough for photographic recording of α, β or γ rays on a moving film, using a narrow slit

539.16.08 **2867**

A Method for Measuring the Velocity of the Ion Transfer in Rapid Counter Tubes.—P. Huber, F. Alder & E. Baldinger. (*Helv. phys. Acta*, 31st July 1946, Vol. 19, No. 4, pp. 204–206. In German.)

539.16.08 : 621.318.572.015.33 **2868**

On the Pulse Shape in Rapid Counter Tubes.—P. Huber, F. Alder, E. Baldinger & F. Metzger. (*Helv. phys. Acta*, 31st July 1946, Vol. 19, No. 4, pp. 207–211. In German.)

539.16.08 : 621.383 **2869**

The Multiplier as a Counter for Elementary Particles.—K. P. Meyer. (*Helv. phys. Acta*, 31st July 1946, Vol. 19, No. 4, pp. 211–214. In German.)

621.317.39 : 531.719.27 **2870**

Rate-of-Change Meter.—R. W. Treharne, J. A. Kammerer & R. Hofstadter. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 106–107.) "Varistor-compensated circuit converts nonlinear voltage variables into linear voltage variables. Application in radio altimeters shows rate of climb directly, with short time lag." See also 1863 of 1946.

621.317.39 : 621.396.645 : 539.4 **2871**

Carrier-Type Amplifier for Electric Gages.—H. C. Roberts. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 92–95.) A RC-coupled amplifier for use with various types of electrical gauge circuits in static and dynamic tests on strains, pressures, etc., in railway rolling stock, bridges and tracks.

621.317.39.083.7 : 629.13 **2872**

Radio Telemetering for [dynamic] **Testing** [of] **Aircraft in Flight.**—C. L. Frederick. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 861–870.) Description of stabilized oscillators modulated by metering equipment; regulated power supplies; f.m. transmitter; automatic frequency-controlled receiver; and heterodyne analyser used by the U.S. Navy in 1945.

621.357.8 : 537.533.73 **2873**

Electron Diffraction Examination of Electrolytically Polished Surfaces.—J. J. Trillat. (*C. R. Acad. Sci., Paris*, 14th April 1947, Vol. 224, No. 15, pp. 1102–1103.) Tests carried out on samples of pure iron, aluminium and copper show that electrolytic polishing causes the Beilby layer to disappear to an extent depending upon the duration of the operation. The nature of the bath appears to play an important part in the case of aluminium, a metal easily oxidized.

621.365.5 + 621.365.92 **2874**

Industrial Applications of High Frequency.—M. Descarsin. (*Onde élect.*, April 1947, Vol. 27, No. 241, pp. 121–137.) Basic principles, historical development and numerous applications of both induction and dielectric heating.

621.365.5 : 538.2 **2875**

Theory of the Heating of Ferromagnetic Materials by Eddy Currents and by Hysteresis.—Jouguet. (*See* 2752.)

621.365.52 **2876**

Design of Induction Heating Coils for Cylindrical Magnetic Loads.—J. T. Vaughan & J. W. Williamson. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 887–892. Discussion, pp. 1165–1166.) Extension of previous paper (148 of 1946) to design of coils for magnetic loads. Variation in impedance of coil circuit with changing temperature necessitates special design of circuit to absorb maximum power. See also 2271 of 1946.

621.365.92.072.8 **2877**

High Frequency Heating.—J. F. Capper. (*Elect. Times*, 17th April 1947, Vol. 111, No. 2893, pp. 417–421.) Discussion of methods and advantages of automatic loading control.

621.369.2 **2878**

Some Applications of Infra-Red Lamp Radiation to Treatment [of materials], **Drying** [of leather, etc.] **and Baking** [of paints and varnishes].—M. Déribéré. (*Rev. gén. Élect.*, Feb. 1947, Vol. 56, No. 2, pp. 71–74.)

621.38.001.8 **2879**

The Electrical Engineer in the Service of Other Industries.—H. C. Turner & G. M. Tomlin. (*Beama J.*, Feb. 1947, Vol. 54, No. 116, pp. 57–64.) Abridgment of I.E.E. Measurement Section paper. A description of various electronic instruments used in test processes, including a magnetic sorting bridge for indicating variations in purity, heat treatment, hardness and depth of carburization in steels. Two types of vibration analyser are described and details given of the use of supersonic equipment in metal testing and measurement of thickness of metallic films.

621.38.001.8 : 621.317 **2880**

Valves and Their Industrial Low-Current Applications.—F. Fanchamps. (*Bull. sci. Ass. Inst. électrotechn. Montefiore*, Jan. 1947, Vol. 60, No. 1, pp. 11–34.) Describes the basic principles of valve methods of measurement of various quantities, with applications in engineering and automatic control.

621.383.4 **2881**

High-Sensitivity Photoconductive Cell.—Hewlett. (*See* 2972.)

621.384.6.07 **2882**

Stabilizing Linear Particle Accelerators by Means of Grid Lenses.—D. Gabor. (*Nature, Lond.*, 1st March 1947, Vol. 159, No. 4035, pp. 303–304.) The mode of action of grid lenses is outlined, and their advantages described. "Grid lenses may well compete with beryllium foils in the stabilization of linear accelerators for extreme energies."

621.385.833 : [538.311 + 621.316.97].083 **2883**

Measurement of Feeble Magnetic Fields and of the Effects of Shielding. Application to the Electron Microscope.—Charles. (*See* 2753.)

621.386.1 : 544 **2884**

Apparatus and Techniques for Practical Chemical Identification by X-Ray Diffraction.—C S Smith & R. L. Barrett. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 177–191.)

621.398 : 621.397.6 **2885**

Miniature Airborne Television Equipment.—Kell & Sziklai. (*See* 2961.)

621.398 : 629.13 **2886**

Guide Beam Control Technic for V-2 Rockets.—G. Hausz. (*Tele-Tech*, March 1947, Vol. 6, No. 3, pp. 76–80.) The Leitstrahl (LS) system operated on frequencies in the range 42–64 Mc/s and used two narrow beams from a transmitter 5–10 miles behind the launching point and on the line from there to the target. The beams were directed at angles of 0.4° on either side of this line, that on the left being modulated at 5 kc/s and the other at 7 kc/s. The two beams were switched on alternately for 0.01 sec. In the missile, equal amplitude signals were only received when on course. Deviations gave rise to an error voltage which was applied to control circuits to correct the deviations. The high accuracy obtained was largely due to the aerial assembly, which consisted of two horizontal $\lambda/2$ dipoles, 220 yd apart, giving a system of very narrow beams, only two of which were used. A capacitor switching system was employed. Details of the transmitter-wagon and missile-borne equipments are given, with block diagrams. See also 2512 of August.

621.398 : 629.13 : 621.397.6 **2887**

Flying Torpedo with an Electric Eye.—Zworykin. (*See* 2962.)

621.398 : 629.135.52 **2888**

Radio Control of Model Flying Boats.—V. Welge. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 526–530.) Control is effected by variations in amplitude of seven audio modulating tones on a carrier in the frequency band 116.0–118.5 Mc/s.

PROPAGATION OF WAVES

621.396.11 **2889**

On the Field of Radio Waves between Two Semiconducting [imperfectly conducting] **Surfaces.**—P. A. Ryazin & L. M. Brekhovskikh. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 3, pp. 285–305. In Russian.) Starting from Maxwell's equations and boundary conditions (2), the case is discussed where the field is excited by a vertical dipole located in the intermediate non-conducting space at any arbitrary height above the lower medium. The boundary surfaces of the media are assumed to be flat and parallel (Fig. 1). The problem is thus similar to that of the propagation of radio waves between the surface of the earth and the ionosphere if the above assumptions can be applied to the latter case.

The main results obtained are : (*a*) At large distances the waves in the intermediate air layer are of the surface type as distinct from the space type. (*b*) The variation of the intensity and phase of radio waves near the earth's surface is calculated. Sommerfeld's solution taking into account only one boundary surface is a particular case of the more general theory developed in this paper. (*c*) The phase velocity of waves, at least of the longer wavelengths, exceeds the velocity of light. (*d*) It is confirmed that the attenuation factor in Austin's and other empirical formulae is of exponential form.

621.396.11 **2890**

On the Propagation and Dispersion of Radio Waves.—V. A. Fock. (*Viestnik Akad. Nauk, S.S.S.R.*, 1946, No. 3, pp. 23–34. In Russian.) A general elementary survey introducing methods developed by the author.

621.396.11 : 538.566 **2891**

Diffraction of Radio Waves around the Earth's Surface.—V. Fock. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 4, pp. 255–266.) Full paper, of which a summary was noted in 160 of 1946.

621.396.11 : 551.5 **2892**

The Mode Theory of Tropospheric Refraction and Its Relation to Wave-Guides and Diffraction.—H. G. Booker & W. Walkinshaw. (*Physical Society Special Report on Meteorological Factors in Radio-Wave Propagation*, pp. 80–127.) The bearing of the theory of waveguides upon refraction, particularly of radio waves, in the troposphere and upon diffraction beyond the horizon is explained in detail. Propagation curves suitable at any rate for a qualitative description of the effects of tropospheric radio refraction are given. Atmospheric propagation may be described in terms of a series of characteristic E- or H- waves similar to those which can travel between parallel metal sheets. The lower edge of the track of these waves often, but not always, coincides with the earth's surface. The height of the upper edge depends on the distribution of refractive index with height and upon the order of the mode involved.

Beyond the horizon the E_1- or H_1- wave becomes predominant. Normally all the characteristic waves leak copiously from the tops of their tracks, but under conditions of superrefraction the degree of this leakage is reduced and may even be entirely suppressed for the first mode at metre wavelengths and below. This wave can then produce at long range a remarkably high field strength within its track.

The degree of leakage is controlled primarily by the lapse-rate of refractive index within the track of the first mode, that is, at heights up to about 35 ft for λ 10 cm, 750 ft for λ 10 m, and 16 000 ft for λ 1 km.

621.396.11 : 551.5 **2893**

A Variational Method for Determining Eigen-Values of the Wave Equation applied to Tropospheric Refraction.—G. G. Macfarlane. (*Proc. Camb. phil. Soc.*, April 1947, Vol. 43, Part 2, pp. 213–219.) A general method of solution for both real and complex eigen-values corresponding to any type of atmospheric refractive index profile. There existed previously two methods of analysis for problems on the tropospheric refraction of radio waves, the perturbation method applicable to cases where energy leaks considerably from an atmospheric duct, and Rayleigh's method, which may be applied in the case of real eigen-values, or trapped modes of propagation. The present work may be considered as an extension of Rayleigh's method to the case of complex eigen-values. An example is given of the use of the method when the refractive index varies with height according to a power law. See also 2894 and 2892.

621.396.11 : 551.5 **2894**

A Method for deducing the Refractive-Index Profile of a Stratified Atmosphere from Radio Observations.—G. G. Macfarlane. (*Physical Society Special Report on Meteorological Factors in Radio-Wave Propagation*, pp. 250–252.) A profile of refractive index can be obtained either from one set of radio height-gain measurements at a fixed range and a few measurements of field strength at a constant height, or from two sets of height-gain measurements at different wavelengths. Such a profile may be more reliable for predicting radio field strengths than one obtained from a single meteorological sounding. See also 2893 above.

621.396.11 : 551.510.535 **2895**

The Application of Ionospheric Data to Radio Communication Problems : Part 2.—E. V. Appleton & W. J. G. Beynon. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 58–76.) " Graphs are given from which may be estimated the maximum usable frequency of radio waves reflected by an ionospheric layer in oblique incidence transmission. The curves based on the theory given in part 1 of the paper are drawn for such ranges of layer thickness and layer height as are met with in practice. The limitations in the accuracy and applicability of the theory in practice are briefly discussed. Attention is also drawn to the occurrence of abnormal transmission conditions under which long-distance communication via the ionosphere is possible on frequencies exceeding the normally predicted values." For part 1 see 3290 of 1940.

621.396.11 : 551.510.535 **2896**

Oblique Radio Transmission in the Ionosphere, and the Lorentz Polarisation Term.—W. J. G. Beynon. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 97–107.) The work of Ratcliffe (15 of 1940) upon the appropriateness of the Sellmeyer or Lorentz dispersion formulae in this connection is extended and shown to be consistent with that of Newbern Smith (1586 of 1941). The analysis is applied to a large number of experimental results. The maximum usable frequencies over distances of 1 000 km and 700 km were found to depart from the values calculated using the Sellmeyer formula by only 0.2 and 0.03 respectively of the amount that would be expected if the Lorentz formula applied.

These experimental results are thus in agreement with the theoretical conclusion of Darwin (1934 Abstracts, p. 606) that the Sellmeyer type of formula is applicable to the case of the refraction of radio waves in the ionosphere.

621.396.11 : 551.510.535 **2897**

Gyro Interaction of Radio Waves.—L. G. H. Huxley, H. G. Foster & C. C. Newton. (*Nature, Lond.*, 1st March 1947, Vol. 159, No. 4035, pp. 300–301.) An outline of preliminary experimental data and discussion of results. For the tests, the modulation introduced by two suitably situated transmitters operating near the gyro-frequency, on 200-kc/s signals from Droitwich, was observed. Certain of the main features of Bailey's theory were confirmed quantitatively. The practical implications of the results are mentioned. For Bailey's theory see 1934 Abstracts, p. 606, and 840 of 1937.

621.396.11 : 551.510.535 **2898**

Predicting Amateur "Conditions".—N. A. Atwood. (*QST*, April 1947, Vol. 31, No. 4, pp. 21–25, 120.) A new method for quick determination of the best 'working area' from a given position using Central Radio Propagation Laboratory maximum usable frequency charts.

621.396.11.029.62 : 551.510.535 **2899**

Six-Metre Transatlantic Signals.—R. Naismith. (*Wireless World*, May 1947, Vol. 53, No. 5, p. 186.) The recent reception of these signals coincided with a high value of vertical-incidence critical frequency for region F_2 and a theoretical maximum frequency for transmission by the tangential ray of 48.9 Mc/s. Alternative modes of propagation are considered and rejected. This therefore is the first proved case of highly efficient transmission over 6 000 km involving only one reflection.

621.396.11.029.64 **2900**

Wave Theoretical Interpretation of Propagation of 10-Centimeter and 3-Centimeter Waves in Low-Level Ocean Ducts.—C. L. Pekeris. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 453–462.) An analysis of results obtained in the West Indies. "Below the horizon, the 10-centimeter wave was found to propagate by the first normal mode with a theoretical decrement of 1 decibel per nautical mile, as against an observed value of about 0.8 decibel per nautical mile in the first 80 miles from transmitter. Theory verified the observed constancy of decrement with height for this wavelength. Beyond 80 miles the observed rate of attenuation dropped to a low value of 0.2 decibel per nautical mile. This change of slope in the intensity curve is probably due to the emergence of scattered radiation after the direct diffracted beam had been depleted." With the exception of one point there is quantitative agreement between the observed and theoretical distribution of intensity with height for the 10 cm wave.

"The 3-centimeter wave was found to propagate below the horizon by the first and second modes, with theoretical decrements of zero and 0.5 decibel per nautical mile, respectively. The latter agrees with the observed values at high elevations, but near the surface, where theoretically attenuation should be negligible, the observed rate of attenuation exceeds the theoretical value by about 0.3 decibel per nautical mile. This is probably due to attenuation by scattering from horizontal inhomogeneities in the distribution of refractive index, and from the rough surface. Theory verifies the observed increase of decrement and decrease of intensity with height above about 10 feet for the 3-centimeter band."

621.396.4.029.62 **2901**

A Multi-Channel V.H.F. Radio Communications System.—Knox & Brereton. (*See* 2927.)

621.396.41.029.64 **2902**

On the Calculation of Multiplex Radio-Telephone Links on Ultra-Short Waves.—H. Chireix. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 3–12.) Reprint of 1559 of May.

621.396.812 : 523.323 **2903**

Effect of the Moon on Radio Wave Propagation.—(*Nature, Lond.*, 22nd March 1947, Vol. 159, No. 4038, p. 396.) P. A. de G. Howell claims to have observed during 1938–39 and 1944–45 a correlation between long-distance transmission conditions and the moon's phase. High signal level, low noise and little fading are associated with full moon and the reverse with new moon.

621.396.812 : 621.396.96 **2904**

A Theory of the Performance of Radar on Ship Targets.—M. V. Wilkes & J. A. Ramsay. (*Proc. Camb. phil. Soc.*, April 1947, Vol. 43, Part 2, pp. 220–231.) An expression is derived for the power returned to the receiver of a radar installation from a ship surface. Conditions of superrefraction are not considered; under normal conditions, provided a suitable value of effective earth radius is taken, good agreement with experimental results on the variation of signal strength with range is obtained. Measurements using a balloon-borne metallized sphere are also described.

621.396.812.029.64 : 551.510.52 **2905**

Radar Reflections from the Lower Atmosphere.—Friis. (*See* 2769.)

621.396.11 : 551.5 **2906**

Meteorological Factors in Radio-Wave Propagation. [Book Notice]—Physical Society, London, 325 pp., 24s. Report of a Conference held on 8th April 1946 by the Physical Society and the Royal Meteorological Society. Individual papers will be abstracted in due course.

RECEPTION

621.396.619.11/.13 **2907**

Laboratory Tests of Weak Signal Narrow-Band F.M.—O. G. Villard, Jr. (*CQ*, April 1947, Vol. 3, No. 4, pp. 21–26..72.) When an a.m. receiver is used for the reception of a.m. transmissions and also of f.m. transmissions by distuning, narrow-band f.m. gives better results for the same carrier power on strong signals, but poorer results on weak signals not much above the background noise level.

621.396.619.13.029.62 : 621.396.933 **2908**

Comparing F.M. with A.M. for Aircraft Communications.—(*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 52–56..111.) "For military [v.h.f.] operations, [narrow-band] f.m. has capabilities for greater range and noise suppression, is less critical as to tuning, less susceptible to jamming."

621.396.621 + 621.396.69 **2909**

Machine for Receiver Manufacture.—(*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 163–164.) A short account of the equipment described in 1913 of June (Sargrove).

621.396.621 **2910**

High-Fidelity Receiver.—R. Gondry. (*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 136–143.) A detailed description, with complete circuit diagram and performance curves, of a receiver with variable selectivity, low and high tone control, adjustable expansion, a switch for speech or music and a high-power output amplifier.

621.396.621 : 621.396.61 **2911**

Technical Characteristics of Transmitters.—E. Aisberg. (*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 132–134.) Stresses the importance, in the design of receivers, of detailed knowledge of the frequency and modulation characteristics, intensity ratios, etc., of the transmissions to be received.

621.396.621.029.62 : 621.317.1 **2912**

The Testing Procedure for F.M. V.H.F. Receivers.—E. M. Fanker & R. A. Ratcliffe. (*Proc. Instn Radio Engrs, Aust.*, March 1947, Vol. 8, No. 3, pp. 4–12. Discussion, pp. 12–16.) The fundamental operating principles are discussed when they differ from those of a.m. circuits. The alignment procedure and methods for measuring the receiver characteristics are described and values given for typical equipment.

621.396.621.076.2.029.62/.63 **2913**

Very High Precision Tunable Receiver for V.H.F.—S. Y. White. (*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 48–51..107.) Description of a receiver with permeability tuning and plug-in tank circuits for use between 60 and 600 Mc/s.

621.396.621.078 **2914**

Automatic Controls in Modern Receivers.—F. Juster. (*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 150–153.) A concise account of delayed a.v.c., the Lamb system for parasitic suppression and a.f.c. (automatic frequency control). The last is strongly recommended.

621.396.722 : 534.32 **2915**

Distortion and Acoustic Preferences.—Moir. (*See* 2656.)

621.396.82 : 551.57 : 629.135
621.319.74 : 551.57 : 629.135 **2916**

Electrostatic Ills and Cures of Aircraft : Parts 1 & 2.—R. Beach. (*Elect. Engng, N.Y.*, April & May 1947, Vol. 66, Nos. 4 & 5, pp. 325–334 & 453–462.) In part 1, "the process by which electrification is accumulated [by aircraft in flight] and the mechanism by which radio interference is produced are described." In part 2 various methods for dissipating static charges on aircraft are given. Experimental results show the effectiveness of metallic bristles, with chemically etched points, for suppressing static interference.

621.396.822 : 621.396.615.17 **2917**

Noise Signal Generator.—Dolphin. (*See* 2859.)

621.396.822 : 621.396.621.53 **2918**

Noise-Figure Reduction in Mixer Stages.—M. J. O. Strutt. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, p. 496.) Corrections to 1573 of May.

621.396.822 : 621.396.645 **2919**

Noise Factor: Part 3.—L. A. Moxon. (*Wireless World*, May 1947, Vol. 53, No. 5, pp. 171–176.) Discussion of: noise sources in an r.f. amplifier and the circuit quantities which determine their effect; the meaning of equivalent noise resistance as applied to valve shot noise; formulae for the noise factor; and the use of grounded-grid and neutralized triodes as the first valves in v.h.f. receivers. For parts 1 & 2 see 864 of March and 1196 of April.

621.396.822.029.63 : 523.78"1946.11.23" **2920**

Micro-Wave Solar Noise Observations during the Partial Eclipse of November 23, 1946.—Covington. (*See* 2761.)

621.396.822.08 : 621.396.645 **2921**

Linearity Range of Noise-Measuring Amplifiers.—Bell. (*See* 2718.)

621.396.828 **2922**

The Suppression of Radio Interference from Electrical Appliances.—S. F. Pearce. (*Beama J.*, Feb. 1947, Vol. 54, No. 116, pp. 40–47.) A description of a number of circuits for efficient suppression in a wide range of appliances. The components requiring careful design are the capacitor for earthed appliances and the line inductor for those which are not earthed. For satisfactory performance at frequencies above 30 Mc/s a 'bushing type' capacitor is necessary in which the current-carrying conductor passes through the body of the capacitor. Design particulars are given for filters having an insertion loss of about 80 db in the range 5–100 Mc/s, with a formula for calculating the lowest frequency at which the required attenuation is obtained.

STATIONS AND COMMUNICATION SYSTEMS

621.394.14 **2923**

Table of Q-Code.—(*Radio, Moscow*, June 1946, No. 3, p. 51. In Russian.) With meanings and Russian equivalents.

621.395.44.029.6 **2924**

2 000 Telegrams per Minute by Microwave.—J. Z. Millar. (*Tele-Tech*, March 1947, Vol. 6, No. 3, pp. 36–40.) A description of the equipment of the New York–Philadelphia link. See also 1578 of May.

621.396(675)"1939/1945" **2925**

Development of Telecommunications in the Belgian Congo during the War.—J. G. Jonlet. (*Bull. sci. Ass. Inst. électrotechn. Montefiore*, Feb. 1947, Vol. 60, No. 2, pp. 43–63.) Historical, with some details of the 50-kW short-wave transmitter put into service in 1943. See also 870 of March.

621.396.1 : 621.396.96 **2926**

Radar Allocations.—Markus. (*See* 2788.)

621.396.4.029.62 **2927**

A Multi-Channel V.H.F. Radio Communications System.—J. B. Knox & C. H. Brereton. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 179–198.) A description of the installation of a f.m. network (42–50 Mc/s) on the Canadian Pacific coast. The results of propagation tests are discussed and land profiles of test and operative links are given. The aerial systems and equipment are briefly described and a statistical analysis of recorded field strengths for various stations is shown graphically.

621.396.41.029.64 **2928**

On the Calculation of Multiplex Radio-Telephone Links on Ultra-Short Waves.—Chireix. (*See* 2902.)

621.396.6 : 551.510.535 **2929**

Ionosphere Equipment for Field Use.—G. H. Musselman. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 112–116.) The requirements of a field equipment are listed and modern pulsed measurement systems briefly described. Details are given of a simplified technique with an automatic motor-tuned receiver and a variable-frequency (1.5–4.0 Mc/s) transmitter half a mile distant. Recording is automatic.

621.396.61[.62].029.64 **2930**

Dishing Out the Milliwatts on 10 kMc/s.—Correction to 1931 of June. The last phrase should read "using a Hallicrafter S-29 portable receiver as i.f./a.f. amplifier."

621.396.619.13 : 621.397.5 (94) **2931**

Frequency Modulation and Television.—N. S. Gilmour. (*Proc. Instn Radio Engrs, Aust.*, July 1944, Vol. 5, No. 5, pp. 3–8.) Discusses modern developments with particular reference to post-war application in Australia.

621.396.619.13.029.62 : 621.396.933 **2932**

Comparing F.M. with A.M. for Aircraft Communications.— (*See* 2908.)

621.396.619.16 **2933**

Pulse Modulation and Demodulation Theory.—M. M. Levy. (*J. Brit. Instn Radio Engrs*, March/April 1947, Vol. 7, No. 2, pp. 64–83.) Modulation is accomplished by shifting in time the position of a periodic train of pulses by an amount proportional to the modulating signal; in demodulation the position of one edge of each pulse is moved in time in synchronism with the modulated pulse, so giving a train of variable-width pulses which after detection yield the modulating signal. The nature of the distortion produced by these processes is studied and it is shown that a distortionless pulse communication system can be evolved by following certain simple rules.

621.396.65 **2934**

Radio Relays for Telegraphy.—F. B. Bramhall. (*Telegr. Teleph. Age*, April 1947, Vol. 65, No. 4, pp. 10, 12..32.) Beamed microwaves of frequencies about 3 000 Mc/s used for communication in the U.S.A. See also 876 of March and 1578 of May, U.D.C. of which should more properly be 621.396.65.

621.396.65 **2935**

Development of Radio Relay Systems.—C. W. Hansell. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 367–384.) Survey of development and requirements. Suggested signal to noise ratios: for printer telegraph, 18 db; for on-off-keyed printer telegraph, 21 db; for ordinary telephone, 40 db; for broadcast, facsimile and television, 50 db; and for high quality music, 60 db. The bandwidth occupied by a phase modulated multichannel relay system is $2B + 2Bd/\sqrt{3}$, where B is the modulation frequency band and d is the peak phase deviation.

621.396.65.029.62 : 621.396.93 **2936**

Frequency Modulation Mobile Radiotelephone Services.—H. B. Martin. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 240–252.) A discussion of the proposed use of frequencies in the ranges 30–44 Mc/s and 152–162 Mc/s for common-carrier mobile radiotelephone communication for motor vehicles and surface vessels.

621.396.712.029.58(945) **2937**

Melbourne Division visits "Radio Australia".—(*Proc. Instn Radio Engrs, Aust.*, Feb. 1947, Vol. 8, No. 2, pp. 22–23.) A brief description of the lay-out of the h.f. broadcasting station at Shepparton, Victoria, Australia. See also 2672 above.

621.396.712(489) **2938**

Broadcasting Equipment.—(*Overseas Engr*, March 1947, Vol. 20, No. 234, p. 279.) A short account of the new equipment and studio arrangements at Radio House, Copenhagen.

621.396.712.3(944) **2939**

Broadcasting Studio Equipment.—L. N. Schultz. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1944, Vol. 5, No. 6, pp. 3–17.) Specification of the complete equipment for station 2GB, Sydney.

621.396.73 **2940**

Emergency Broadcast Pickup Techniques.—G. Riley. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 108–111.) Methods and equipment used for emergency outdoor broadcasts by radio station WOR, New York.

621.396.828.029.56/.62 **2941**

The Staggering Band Theorem.—L. E. Rapp. (*QST*, April 1947, Vol. 31, No. 4, pp. 60–61, 136.) A plan to eliminate interference in the amateur frequency bands by devoting particular bands to c.w. transmissions and 'phone transmissions during alternate 24-hour periods.

621.396.931 **2942**

The Development of a Radio Communication Network for the South African Railways.—G. D. Walker. (*Trans. S. Afr. Inst. elect. Engrs*, Dec. 1946, Vol. 37, No. 12, pp. 283–305. Discussion, pp. 305–307.) Sections 1, 2, and 3 give respectively details of the extent of the radio network, the requirements of the service, and the equipment now in use. Eighteen spot frequencies within the band

4–14 Mc/s are used and telephonic as well as telegraphic facilities are provided.

Section 4 deals with aerial design ; a stack of three aerials supported between a single pair of towers is used, each aerial consisting of a 2-fold half-wave dipole.

Section 5 deals with the arrangements for matching the aerial to the 600-Ω feeder at more than one frequency ; a novel form of compound stub is described.

Section 6 describes some pulse transmissions under conditions of oblique incidence on the ionospheric layers.

SUBSIDIARY APPARATUS

621.313.2 **2943**

The "Electrotor".—(*Elect. Rev., Lond.*, 25th April 1947, Vol. 140, No. 3622, pp. 663–664.) Miniature low voltage (1.5–6 V) d.c. motor of novel design ; ring-shaped permanent magnet stator, gap-ring wound rotor with brushes bearing directly upon bared edges of winding. Manufactured in several sizes, the smallest weighing 1 gm and being $\frac{1}{2}$ cm in diameter and length, speed 7 000 r.p.m. and voltage 1.5.

621.314.12 : 621.394/.396].66 **2944**

The Amplidyne.—E. C. Barwick. (*Elect. Times*, 24th April & 1st May 1947, Vol. 111, Nos. 2894 & 2895, pp. 449–453 & 485–488.) A description of a quick response d.c. generator requiring an exceptionally low field power for excitation. Some typical control circuits are described in part 1. Part 2 describes the application of amplidyne control to such equipment as winding gear, cable laying machinery, and synchronous motors. See also 3765 of 1946.

621.314.653 **2945**

Characteristics of Resistance Ignitors.—D. E. Marshall & W. W. Rigrod. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 122–126.) The magnitude of variations of current, voltage and firing time with operating conditions are presented as a guide to designers.

621.316.54 **2946**

Fundamental Properties of the Vacuum Switch.—R. Koller. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp.597–604. Discussion, *ibid.*, December Supplement 1946, Vol. 65, pp. 1141–1142.) Summary noted in 2021 of 1946.

621.316.728 **2947**

Design of Electronically Regulated Power Supplies.—B. A. Penners & W. Davis. (*Radio, N.Y.*, Feb./March 1947, Vol. 31, No. 2, pp. 9–15.) A comprehensive theoretical discussion presenting complete design data.

621.352.8 **2948**

Novel Batteries.—(*Elect. Rev., Lond.*, 11th April 1947, Vol. 140, No. 3620, p. 571.) Development of a new type of battery, based on the electrochemical catalysis of oxygen and hydrogen gases, is now proceeding on behalf of the British Electrical and Allied Industries Research Association at Cambridge University. A small type of silver–silver chloride–magnesium dry cell manufactured during the war by the Burgess Battery Co., Antioch, U.S.A., delivers a large output at low voltage for a short time. Such a cell $1\frac{5}{8}$ inch in diameter, and $3\frac{5}{8}$ inches long gave 100 A at a peak of 1.4 V for $1\frac{1}{2}$ minutes when activated by water. For a full account of these cells, see Reprint 90–33 of the Electrochemical Society of America. See also 901 of March, where U.D.C. should read as above.

621.385.832.087.5 **2949**

Recording Oscilloscope Images.—(*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 45–46.) A beam splitter in the camera for radar oscilloscopes reflects blue light to the camera lens and transmits orange-yellow light for the operator's vision, thus permitting simultaneous inspection and photography.

621.398 **2950**

Magslip Transmission.—(*Engineer, Lond.*, 11th April 1947, Vol. 183, No. 4759, pp. 317–319.) A brief outline of the principles of Magslip transmission and its application to gunnery work. The rapid development of Magslip production during the war is described and the construction of a typical transmitter unit is shown. The rigorous tests necessary to maintain the high standard of mechanical and electrical precision are stressed. See also 2585 of August.

TELEVISION AND PHOTOTELEGRAPHY

621.397 : 38 **2951**

Commercial Applications for Picture Telegraphy.—R. C. Walker. (*Electronic Engng*, Feb. 1947, Vol. 19, No. 228, pp. 44–45.) An account of methods of facsimile transmission using 'Teledeltos', a dry recording paper needing no processing. The system is used for telegraphy and transmission of drawings.

621.397 : 621.357.087 **2952**

Electro-Chemical Recording.—C. P. Fagan. (*Marconi Rev.*, Oct./Dec. 1946, Vol. 9, No. 83, pp. 146–150.) Methods used for facsimile work etc. are briefly described, with special attention to azo-dye recording.

621.397.5 : 6 **2953**

Television System for Industrial Applications.—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 138..156.) A television system for visual inspection of operations on a factory production line from a remote point.

621.397.5 : 621.315.213.12 **2954**

Development of an Ultra Low Loss Transmission Line for Television.—Johnson. (*See* 2667.)

621.397.5 : 621.396.67 **2955**

Television Antennas for Apartments.—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 96–102.) The possibility of installing master aerials feeding many receivers is discussed. Existing systems in the U.S.A. for broadcast and short-wave signal reception are described and the difficulties to be overcome in an u.h.f. system are stated. The aerials would probably consist of separate dipoles and reflectors for each local television station, tuned and orientated for optimum reception, and each channel would require a wide-band booster amplifier. Typical proposed designs, both with and without amplifiers, are described and the requirements of the amplifiers and methods of matching to the customer's feeder-line are discussed.

621.397.5(94) : 621.396.619.13 **2956**

Frequency Modulation and Television.—Gilmour. (*See* 2931.)

621.396.11 : 551.510.535 **2896**

Oblique Radio Transmission in the Ionosphere, and the Lorentz Polarisation Term.—W. J. G. Beynon. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 97–107.) The work of Ratcliffe (15 of 1940) upon the appropriateness of the Sellmeyer or Lorentz dispersion formulae in this connection is extended and shown to be consistent with that of Newbern Smith (1586 of 1941). The analysis is applied to a large number of experimental results.

The maximum usable frequencies over distances of 1 000 km and 700 km were found to depart from the values calculated using the Sellmeyer formula by only 0.2 and 0.03 respectively of the amount that would be expected if the Lorentz formula applied.

These experimental results are thus in agreement with the theoretical conclusion of Darwin (1934 Abstracts, p. 606) that the Sellmeyer type of formula is applicable to the case of the refraction of radio waves in the ionosphere.

621.396.11 : 551.510.535 **2897**

Gyro Interaction of Radio Waves.—L. G. H. Huxley, H. G. Foster & C. C. Newton. (*Nature, Lond.*, 1st March 1947, Vol. 159, No. 4035, pp. 300–301.) An outline of preliminary experimental data and discussion of results. For the tests, the modulation introduced by two suitably situated transmitters operating near the gyro-frequency, on 200-kc/s signals from Droitwich, was observed. Certain of the main features of Bailey's theory were confirmed quantitatively. The practical implications of the results are mentioned. For Bailey's theory see 1934 Abstracts, p. 606, and 840 of 1937.

621.396.11 : 551.510.535 **2898**

Predicting Amateur "Conditions".—N. A. Atwood. (*QST*, April 1947, Vol. 31, No. 4, pp. 21–25, 120.) A new method for quick determination of the best 'working area' from a given position using Central Radio Propagation Laboratory maximum usable frequency charts.

621.396.11.029.62 : 551.510.535 **2899**

Six-Metre Transatlantic Signals.—R. Naismith. (*Wireless World*, May 1947, Vol. 53, No. 5, p. 186.) The recent reception of these signals coincided with a high value of vertical-incidence critical frequency for region F_2 and a theoretical maximum frequency for transmission by the tangential ray of 48.9 Mc/s. Alternative modes of propagation are considered and rejected. This therefore is the first proved case of highly efficient transmission over 6 000 km involving only one reflection.

621.396.11.029.64 **2900**

Wave Theoretical Interpretation of Propagation of 10-Centimeter and 3-Centimeter Waves in Low-Level Ocean Ducts.—C. L. Pekeris. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 453–462.) An analysis of results obtained in the West Indies. "Below the horizon, the 10-centimeter wave was found to propagate by the first normal mode with a theoretical decrement of 1 decibel per nautical mile, as against an observed value of about 0.8 decibel per nautical mile in the first 80 miles from transmitter. Theory verified the observed constancy of decrement with height for this wavelength. Beyond 80 miles the observed rate of attenuation dropped to a low value of 0.2 decibel per nautical mile. This change of slope in the intensity curve is probably due to the emergence of scattered radiation after the direct diffracted beam had been depleted." With the exception of one point there is quantitative agreement between the observed and theoretical distribution of intensity with height for the 10 cm wave.

"The 3-centimeter wave was found to propagate below the horizon by the first and second modes, with theoretical decrements of zero and 0.5 decibel per nautical mile, respectively. The latter agrees with the observed values at high elevations, but near the surface, where theoretically attenuation should be negligible, the observed rate of attenuation exceeds the theoretical value by about 0.3 decibel per nautical mile. This is probably due to attenuation by scattering from horizontal inhomogeneities in the distribution of refractive index, and from the rough surface. Theory verifies the observed increase of decrement and decrease of intensity with height above about 10 feet for the 3-centimeter band."

621.396.4.029.62 **2901**

A Multi-Channel V.H.F. Radio Communications System.—Knox & Brereton. (*See* 2927.)

621.396.41.029.64 **2902**

On the Calculation of Multiplex Radio-Telephone Links on Ultra-Short Waves.—H. Chireix. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 3–12.) Reprint of 1559 of May.

621.396.812 : 523.323 **2903**

Effect of the Moon on Radio Wave Propagation.—(*Nature, Lond.*, 22nd March 1947, Vol. 159, No. 4038, p. 396.) P. A. de G. Howell claims to have observed during 1938–39 and 1944–45 a correlation between long-distance transmission conditions and the moon's phase. High signal level, low noise and little fading are associated with full moon and the reverse with new moon.

621.396.812 : 621.396.96 **2904**

A Theory of the Performance of Radar on Ship Targets.—M. V. Wilkes & J. A. Ramsay. (*Proc. Camb. phil. Soc.*, April 1947, Vol. 43, Part 2, pp. 220–231.) An expression is derived for the power returned to the receiver of a radar installation from a ship surface. Conditions of superrefraction are not considered; under normal conditions, provided a suitable value of effective earth radius is taken, good agreement with experimental results on the variation of signal strength with range is obtained. Measurements using a balloon-borne metallized sphere are also described.

621.396.812.029.64 : 551.510.52 **2905**

Radar Reflections from the Lower Atmosphere.—Friis. (*See* 2769.)

621.396.11 : 551.5 **2906**

Meteorological Factors in Radio-Wave Propagation. [Book Notice]—Physical Society, London, 325 pp., 24s. Report of a Conference held on 8th April 1946 by the Physical Society and the Royal Meteorological Society. Individual papers will be abstracted in due course.

RECEPTION

621.396.619.11/.13 **2907**

Laboratory Tests of Weak Signal Narrow-Band F.M.—O. G. Villard, Jr. (*CQ*, April 1947, Vol. 3, No. 4, pp. 21–26..72.) When an a.m. receiver is used for the reception of a.m. transmissions and also of f.m. transmissions by distuning, narrow-band f.m. gives better results for the same carrier power on strong signals, but poorer results on weak signals not much above the background noise level.

621.396.619.13.029.62 : 621.396.933 **2908**

Comparing F.M. with A.M. for Aircraft Communications.—(*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 52–56..111.) “ For military [v.h.f.] operations, [narrow-band] f.m. has capabilities for greater range and noise suppression, is less critical as to tuning, less susceptible to jamming.”

621.396.621 + 621.396.69 **2909**

Machine for Receiver Manufacture.—(*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 163–164.) A short account of the equipment described in 1913 of June (Sargrove).

621.396.621 **2910**

High-Fidelity Receiver.—R. Gondry. (*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 136–143.) A detailed description, with complete circuit diagram and performance curves, of a receiver with variable selectivity, low and high tone control, adjustable expansion, a switch for speech or music and a high-power output amplifier.

621.396.621 : 621.396.61 **2911**

Technical Characteristics of Transmitters.—E. Aisberg. (*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 132–134.) Stresses the importance, in the design of receivers, of detailed knowledge of the frequency and modulation characteristics, intensity ratios, etc., of the transmissions to be received.

621.396.621.029.62 : 621.317.1 **2912**

The Testing Procedure for F.M. V.H.F. Receivers.—E. M. Fanker & R. A. Ratcliffe. (*Proc. Instn Radio Engrs, Aust.*, March 1947, Vol. 8, No. 3, pp. 4–12. Discussion, pp. 12–16.) The fundamental operating principles are discussed when they differ from those of a.m. circuits. The alignment procedure and methods for measuring the receiver characteristics are described and values given for typical equipment.

621.396.621.076.2.029.62/.63 **2913**

Very High Precision Tunable Receiver for V.H.F.—S. Y. White. (*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 48–51..107.) Description of a receiver with permeability tuning and plug-in tank circuits for use between 60 and 600 Mc/s.

621.396.621.078 **2914**

Automatic Controls in Modern Receivers.—F. Juster. (*Toute la Radio*, May 1947, Vol. 14, No. 115, pp. 150–153.) A concise account of delayed a.v.c., the Lamb system for parasitic suppression and a.f.c. (automatic frequency control). The last is strongly recommended.

621.396.722 : 534.32 **2915**

Distortion and Acoustic Preferences.—Moir. (*See* 2656.)

621.396.82 : 551.57 : 629.135
621.319.74 : 551.57 : 629.135 **2916**

Electrostatic Ills and Cures of Aircraft : Parts 1 & 2.—R. Beach. (*Elect. Engng, N.Y.*, April & May 1947, Vol. 66, Nos. 4 & 5, pp. 325–334 & 453–462.) In part 1, “ the process by which electrification is accumulated [by aircraft in flight] and the mechanism by which radio interference is produced are described.” In part 2 various methods for dissipating static charges on aircraft are given. Experimental results show the effectiveness of metallic bristles, with chemically etched points, for suppressing static interference.

621.396.822 : 621.396.615.17 **2917**

Noise Signal Generator.—Dolphin. (*See* 2859.)

621.396.822 : 621.396.621.53 **2918**

Noise-Figure Reduction in Mixer Stages.—M. J. O. Strutt. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, p. 496.) Corrections to 1573 of May.

621.396.822 : 621.396.645 **2919**

Noise Factor: Part 3.—L. A. Moxon. (*Wireless World*, May 1947, Vol. 53, No. 5, pp. 171–176.) Discussion of : noise sources in an r.f. amplifier and the circuit quantities which determine their effect ; the meaning of equivalent noise resistance as applied to valve shot noise ; formulae for the noise factor ; and the use of grounded-grid and neutralized triodes as the first valves in v.h.f. receivers. For parts 1 & 2 see 864 of March and 1196 of April.

621.396.822.029.63 : 523.78"1946.11.23" **2920**

Micro-Wave Solar Noise Observations during the Partial Eclipse of November 23, 1946.—Covington. (*See* 2761.)

621.396.822.08 : 621.396.645 **2921**

Linearity Range of Noise-Measuring Amplifiers.—Bell. (*See* 2718.)

621.396.828 **2922**

The Suppression of Radio Interference from Electrical Appliances.—S. F. Pearce. (*Beama J.*, Feb. 1947, Vol. 54, No. 116, pp. 40–47.) A description of a number of circuits for efficient suppression in a wide range of appliances. The components requiring careful design are the capacitor for earthed appliances and the line inductor for those which are not earthed. For satisfactory performance at frequencies above 30 Mc/s a ‘ bushing type ’ capacitor is necessary in which the current-carrying conductor passes through the body of the capacitor. Design particulars are given for filters having an insertion loss of about 80 db in the range 5–100 Mc/s, with a formula for calculating the lowest frequency at which the required attenuation is obtained.

STATIONS AND COMMUNICATION SYSTEMS

621.394.14 **2923**

Table of Q-Code.—(*Radio, Moscow*, June 1946, No. 3, p. 51. In Russian.) With meanings and Russian equivalents.

621.395.44.029.6 **2924**

2 000 Telegrams per Minute by Microwave.—J. Z. Millar. (*Tele-Tech*, March 1947, Vol. 6, No. 3, pp. 36–40.) A description of the equipment of the New York–Philadelphia link. See also 1578 of May.

621.396(675)"1939/1945" **2925**

Development of Telecommunications in the Belgian Congo during the War.—J. G. Jonlet. (*Bull. sci. Ass. Inst. électrotechn. Montefiore,* Feb. 1947, Vol. 60, No. 2, pp. 43–63.) Historical, with some details of the 50-kW short-wave transmitter put into service in 1943. See also 870 of March.

621.396.1 : 621.396.96 **2926**

Radar Allocations.—Markus. (*See* 2788.)

621.396.4.029.62 **2927**

A Multi-Channel V.H.F. Radio Communications System.—J. B. Knox & C. H. Brereton. (*RCA Rev.,* June 1946, Vol. 7, No. 2, pp. 179–198.) A description of the installation of a f.m. network (42–50 Mc/s) on the Canadian Pacific coast. The results of propagation tests are discussed and land profiles of test and operative links are given. The aerial systems and equipment are briefly described and a statistical analysis of recorded field strengths for various stations is shown graphically.

621.396.41.029.64 **2928**

On the Calculation of Multiplex Radio-Telephone Links on Ultra-Short Waves.—Chireix. (*See* 2902.)

621.396.6 : 551.510.535 **2929**

Ionosphere Equipment for Field Use.—G. H. Musselman. (*Electronics,* May 1947, Vol. 20, No. 5, pp. 112–116.) The requirements of a field equipment are listed and modern pulsed measurement systems briefly described. Details are given of a simplified technique with an automatic motor-tuned receiver and a variable-frequency (1.5–4.0 Mc/s) transmitter half a mile distant. Recording is automatic.

621.396.61/.62].029.64 **2930**

Dishing Out the Milliwatts on 10 kMc/s.—Correction to 1931 of June. The last phrase should read "using a Hallicrafter S-29 portable receiver as i.f./a.f. amplifier."

621.396.619.13 : 621.397.5 (94) **2931**

Frequency Modulation and Television.—N. S. Gilmour. (*Proc. Instn Radio Engrs, Aust.,* July 1944, Vol. 5, No. 5, pp. 3–8.) Discusses modern developments with particular reference to post-war application in Australia.

621.396.619.13.029.62 : 621.396.933 **2932**

Comparing F.M. with A.M. for Aircraft Communications.— (*See* 2908.)

621.396.619.16 **2933**

Pulse Modulation and Demodulation Theory.—M. M. Levy. (*J. Brit. Instn Radio Engrs,* March/April 1947, Vol. 7, No. 2, pp. 64–83.) Modulation is accomplished by shifting in time the position of a periodic train of pulses by an amount proportional to the modulating signal; in demodulation the position of one edge of each pulse is moved in time in synchronism with the modulated pulse, so giving a train of variable-width pulses which after detection yield the modulating signal. The nature of the distortion produced by these processes is studied and it is shown that a distortionless pulse communication system can be evolved by following certain simple rules.

621.396.65 **2934**

Radio Relays for Telegraphy.—F. B. Bramhall. (*Telegr. Teleph. Age,* April 1947, Vol. 65, No. 4, pp. 10, 12..32.) Beamed microwaves of frequencies about 3 000 Mc/s used for communication in the U.S.A. See also 876 of March and 1578 of May, U.D.C. of which should more properly be 621.396.65.

621.396.65 **2935**

Development of Radio Relay Systems.—C. W. Hansell. (*RCA Rev.,* Sept. 1946, Vol. 7, No. 3, pp. 367–384.) Survey of development and requirements. Suggested signal to noise ratios: for printer telegraph, 18 db; for on-off-keyed printer telegraph, 21 db; for ordinary telephone, 40 db; for broadcast, facsimile and television, 50 db; and for high quality music, 60 db. The bandwidth occupied by a phase modulated multichannel relay system is $2B + 2Bd/\sqrt{3}$, where B is the modulation frequency band and d is the peak phase deviation.

621.396.65.029.62 : 621.396.93 **2936**

Frequency Modulation Mobile Radiotelephone Services.—H. B. Martin. (*RCA Rev.,* June 1946, Vol. 7, No. 2, pp. 240–252.) A discussion of the proposed use of frequencies in the ranges 30–44 Mc/s and 152–162 Mc/s for common-carrier mobile radiotelephone communication for motor vehicles and surface vessels.

621.396.712.029.58(945) **2937**

Melbourne Division visits "Radio Australia".—(*Proc. Instn Radio Engrs, Aust.,* Feb. 1947, Vol. 8, No. 2, pp. 22–23.) A brief description of the lay-out of the h.f. broadcasting station at Shepparton, Victoria, Australia. See also 2672 above.

621.396.712(489) **2938**

Broadcasting Equipment.—(*Overseas Engr,* March 1947, Vol. 20, No. 234, p. 279.) A short account of the new equipment and studio arrangements at Radio House, Copenhagen.

621.396.712.3(944) **2939**

Broadcasting Studio Equipment.—L. N. Schultz. (*Proc. Instn Radio Engrs, Aust.,* Oct. 1944, Vol. 5, No. 6, pp. 3–17.) Specification of the complete equipment for station 2GB, Sydney.

621.396.73 **2940**

Emergency Broadcast Pickup Techniques.—G. Riley. (*Electronics,* May 1947, Vol. 20, No. 5, pp. 108–111.) Methods and equipment used for emergency outdoor broadcasts by radio station WOR, New York.

621.396.828.029.56/.62 **2941**

The Staggering Band Theorem.—L. E. Rapp. (*QST,* April 1947, Vol. 31, No. 4, pp. 60–61, 136.) A plan to eliminate interference in the amateur frequency bands by devoting particular bands to c.w. transmissions and 'phone transmissions during alternate 24-hour periods.

621.396.931 **2942**

The Development of a Radio Communication Network for the South African Railways.—G. D. Walker. (*Trans. S. Afr. Inst. elect. Engrs,* Dec. 1946, Vol. 37, No. 12, pp. 283–305. Discussion, pp. 305–307.) Sections 1, 2, and 3 give respectively details of the extent of the radio network, the requirements of the service, and the equipment now in use. Eighteen spot frequencies within the band

4–14 Mc/s are used and telephonic as well as telegraphic facilities are provided.

Section 4 deals with aerial design ; a stack of three aerials supported between a single pair of towers is used, each aerial consisting of a 2-fold half-wave dipole.

Section 5 deals with the arrangements for matching the aerial to the 600-Ω feeder at more than one frequency ; a novel form of compound stub is described.

Section 6 describes some pulse transmissions under conditions of oblique incidence on the ionospheric layers.

SUBSIDIARY APPARATUS

621.313.2 **2943**

The "Electrotor".—(*Elect. Rev., Lond.*, 25th April 1947, Vol. 140, No. 3622, pp. 663–664.) Miniature low voltage (1.5–6 V) d.c. motor of novel design ; ring-shaped permanent magnet stator, gap-ring wound rotor with brushes bearing directly upon bared edges of winding. Manufactured in several sizes, the smallest weighing 1 gm and being ½ cm in diameter and length, speed 7 000 r.p.m. and voltage 1.5.

621.314.12 : 621.394/.396].66 **2944**

The Amplidyne.—E. C. Barwick. (*Elect. Times*, 24th April & 1st May 1947, Vol. 111, Nos. 2894 & 2895, pp. 449–453 & 485–488.) A description of a quick response d.c. generator requiring an exceptionally low field power for excitation. Some typical control circuits are described in part 1. Part 2 describes the application of amplidyne control to such equipment as winding gear, cable laying machinery, and synchronous motors. See also 3765 of 1946.

621.314.653 **2945**

Characteristics of Resistance Ignitors.—D. E. Marshall & W. W. Rigrod. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 122–126.) The magnitude of variations of current, voltage and firing time with operating conditions are presented as a guide to designers.

621.316.54 **2946**

Fundamental Properties of the Vacuum Switch.—R. Koller. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp.597–604. Discussion, *ibid.*, December Supplement 1946, Vol. 65, pp. 1141–1142.) Summary noted in 2021 of 1946.

621.316.728 **2947**

Design of Electronically Regulated Power Supplies.—B. A. Penners & W. Davis. (*Radio, N.Y.*, Feb./March 1947, Vol. 31, No. 2, pp. 9–15.) A comprehensive theoretical discussion presenting complete design data.

621.352.8 **2948**

Novel Batteries.—(*Elect. Rev., Lond.*, 11th April 1947, Vol. 140, No. 3620, p. 571.) Development of a new type of battery, based on the electrochemical catalysis of oxygen and hydrogen gases, is now proceeding on behalf of the British Electrical and Allied Industries Research Association at Cambridge University. A small type of silver–silver chloride–magnesium dry cell manufactured during the war by the Burgess Battery Co., Antioch, U.S.A., delivers a large output at low voltage for a short time. Such a cell 1⅜ inch in diameter, and 3⅝ inches long gave 100 A at a peak of 1.4 V for 1½ minutes when activated by water. For a full account of these cells, see Reprint 90–33 of the Electrochemical Society of America. See also 901 of March, where U.D.C. should read as above.

621.385.832.087.5 **2949**

Recording Oscilloscope Images.—(*Tele-Tech*, April 1947, Vol. 6, No. 4, pp. 45–46.) A beam splitter in the camera for radar oscilloscopes reflects blue light to the camera lens and transmits orange-yellow light for the operator's vision, thus permitting simultaneous inspection and photography.

621.398 **2950**

Magslip Transmission.—(*Engineer, Lond.*, 11th April 1947, Vol. 183, No. 4759, pp. 317–319.) A brief outline of the principles of Magslip transmission and its application to gunnery work. The rapid development of Magslip production during the war is described and the construction of a typical transmitter unit is shown. The rigorous tests necessary to maintain the high standard of mechanical and electrical precision are stressed. See also 2585 of August.

TELEVISION AND PHOTOTELEGRAPHY

621.397 : 38 **2951**

Commercial Applications for Picture Telegraphy.—R. C. Walker. (*Electronic Engng*, Feb. 1947, Vol. 19, No. 228, pp. 44–45.) An account of methods of facsimile transmission using 'Teledeltos', a dry recording paper needing no processing. The system is used for telegraphy and transmission of drawings.

621.397 : 621.357.087 **2952**

Electro-Chemical Recording.—C. P. Fagan. (*Marconi Rev.*, Oct./Dec. 1946, Vol. 9, No. 83, pp. 146–150.) Methods used for facsimile work etc. are briefly described, with special attention to azo-dye recording.

621.397.5 : 6 **2953**

Television System for Industrial Applications.—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 138..156.) A television system for visual inspection of operations on a factory production line from a remote point.

621.397.5 : 621.315.213.12 **2954**

Development of an Ultra Low Loss Transmission Line for Television.—Johnson. (*See* 2667.)

621.397.5 : 621.396.67 **2955**

Television Antennas for Apartments.—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 96–102.) The possibility of installing master aerials feeding many receivers is discussed. Existing systems in the U.S.A. for broadcast and short-wave signal reception are described and the difficulties to be overcome in an u.h.f. system are stated. The aerials would probably consist of separate dipoles and reflectors for each local television station, tuned and orientated for optimum reception, and each channel would require a wide-band booster amplifier. Typical proposed designs, both with and without amplifiers, are described and the requirements of the amplifiers and methods of matching to the customer's feeder-line are discussed.

621.397.5(94) : 621.396.619.13 **2956**

Frequency Modulation and Television.—Gilmour. (*See* 2931.)

621.397.6 **2957**

A New Type of the Mosaic for the Television Pick Up Tubes.—G. Braude. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 4, pp. 348–350.) The mosaic covers both sides of a thin dielectric plate which has a certain amount of leakage between the two faces.

621.397.6 **2958**

An Experimental Color Television System.—R. D. Kell, G. L. Fredendall, A. C. Schroeder & R. C. Webb. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 141–154.) A description of a demonstration apparatus. Three-colour scanning in sequence is obtained by rotating colour filters synchronized to the frequency of the mains. Three-dimensional colour is obtained by a stereo-attachment for the camera used in conjunction with polarizing material on the rotating colour filters and polarizing spectacles worn by the viewer. The sound channel is transmitted during a portion of the horizontal blanking period.

621.397.6 : 621.383.8 **2959**

Mimo-Miniature Image Orthicon.—P. K. Weimer, H. B. Law & S. V. Forgue. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 358–366.) For use in airborne television equipment; overall length 9 inches and diameter $1\frac{1}{2}$ inches.

621.397.6 : 621.398 **2960**

Naval Airborne Television Reconnaissance System.—R. E. Shelby, F. J. Somers & L. R. Moffett. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 303–337.) High-fidelity long-range airborne television reconnaissance system developed by U.S. Navy Department; 20 frames per second, 40 fields per second, 567 lines per frame interlaced and 5 Mc/s bandwidth are used. With peak power of 1 400 W, maximum plane-to-ground range was 200 miles. Satisfactory definition was obtained at altitudes from 5 000 to 10 000 ft.

621.397.6 : 621.398 **2961**

Miniature Airborne Television Equipment.—R. D. Kell & G. C. Sziklai. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 338–357.) "A developmental television camera, designed especially for airborne applications and using the image orthicon, is described. This camera is part of a complete airborne television transmitter system weighing 50 pounds. The transmitter has a power output of eight watts in the 260-to-380 megacycle range. Experimental results in guiding a medium-angle bomb with the aid of the miniature equipment are given."

621.397.6 : 621.398 : 629.13 **2962**

Flying Torpedo with an Electric Eye.—V. K. Zworykin. (*RCA Rev.*, Sept. 1946, Vol. 7, No. 3, pp. 293–302.) Memorandum prepared as early as 1934 giving suggestion for controlling guided missiles by television.

621.397.62 **2963**

Philco Projection TV Receiver.—(*Tele-Tech*, March 1947, Vol. 6, No. 3, pp. 41, 127.) An instrument using a modified Schmidt optical system with a 4-inch 20-kV projection tube to give a 15 inch by 20 inch picture, of great brightness and contrast.

621.397.62 : 621.396.828 **2964**

On the Reduction of Noise [souffle] **in Certain Television Analysers using Slow Electrons.**—R. Barthélemy. (*C. R. Acad. Sci., Paris*, 31st March 1947, Vol. 224, No. 13, pp. 977–978.) Certain American receivers make use of electron multipliers in the analysers. The modulated fraction of the beam entering the multiplier is very small, about 5–10% of the mean intensity. Improved performance can be achieved by filtration of the beam, either by deviation or by a suitably polarized grid, so that only the useful part of the current passes forward into the multiplier.

621.397.74 : 621.315.212 **2965**

The Provision in London of Television Channels for the B.B.C.—Mitchell. (*See* 2666.)

621.397.62 **2966**

Television Receiving Equipment. [Book Review]—W. T. Cocking. Iliffe & Sons, 2nd edn, 354 pp., 12s. 6d. (*J. Brit. Instn Radio Engrs*, March/April 1947, Vol. 7, No. 2, p. 63.) Covers many of the improvements in technique which have been effected in late years and is recommended for the use of students.

TRANSMISSION

621.396.61 : 621.396.621 **2967**

Technical Characteristics of Transmitters.—Aisberg. (*See* 2911.)

621.396.61.029.62 **2968**

A Complete 10-Meter Mobile Station.—C. T. Haist. (*CQ*, April 1947, Vol. 3, No. 4, pp. 15–19..76.) Circuits and description of 50-W equipment operated from a 12-V car battery. An 829B h.f. transmitting valve is used in the power amplifier.

VALVES AND THERMIONICS

537.291 **2969**

Exchange of Energy between an Electron Beam and an Electromagnetic Field of Feeble Intensity.—P. Guénard. (*C. R. Acad. Sci., Paris*, 24th March 1947, Vol. 224, No. 12, pp. 898–900.) An expression is derived for the ratio of the mean power, given up by the beam while traversing the field, to the beam power where it enters the field, for the particular case of small signals.

621.38/.39].029.64 **2970**

Microwave Electronics.—Slater. (*See* 2668.)

621.383 : 535.215.2 **2971**

Fatigue of Ag-Cs_2O, Ag-Cs Photoelectric Surfaces.—S. Pakswer. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 203–206.) Description of fatigue phenomena for red and blue light. Theory suggests a change in selective absorption caused by polarization of the Cs atoms.

621.383.4 **2972**

High-Sensitivity Photoconductive Cell.—C. W. Hewlett. (*Gen. elect. Rev.*, April 1947, Vol. 50, No. 4, pp. 22–25.) Construction, performance and applications of a thallous sulphide semiconductor cell developed by G.E.C. (U.S.A.).

621.385 : 666.1 **2973**

Glass in the Radio Industry.—Violet, Danzin & Commin. (*See* 2819.)

621.385.029.63/.64 **2974**

Tentative Theory of the Travelling-Wave Valve.—J. Bernier. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 87–101.) The travelling-wave valve is considered as made up of a transmission line (or waveguide) of low phase propagation velocity, closed at each end by its characteristic impedance, with uniformly distributed sources of field, these sources being due to the effect of the electron beam. The gain of such valves is calculated ; it increases with the current and the length of the line. In general the bandwidth decreases as the gain increases. The travelling-wave valve is somewhat analogous to a cascade of triodes coupled by Lecher lines. Modifications of the theory are indicated when the transmission line has many modes of propagation and the case is discussed where the line consists of a waveguide filled with a dielectric of high refractive index.

621.385.032.7 + 621.32.032.7] : 001.4 **2975**

Nomenclature System for Glass Bulbs.—A. Brann. (*Electronics*, May 1947, Vol. 20, No. 5, pp. 184..188.) American system for bulbs used in electric lamp and valve manufacture.

621.385.1 + 621.396.694 **2976**

Tube Registry.—(*Electronics*, May 1947, Vol. 20, No. 5, pp. 254..259.) Summary of valve information furnished by the R.M.A. Data Bureau. Types listed are :

5549. Forced-air-cooled triode. Directly heated. 12.6 V. Anode dissipation 4 kW.

5559 (revised). Indirectly heated, mercury thyratron triode. Ionization time 10 μs. Deionization time 1 ms.

5557. Same as 5559 (revised) except directly heated.

For 6C23, 8C22 and other valves not listed above, see 2288 of July.

621.385.1.012(4) **2977**

Radio Valves : Western European Valves.—K. I. Drozdoff. (*Radio, Moscow*, June 1946, No. 3, pp. 52–61. In Russian.) Definitions of continental code, and diagrams of valve bases for the E-11 and U-11 series.

621.385.1.012(4) **2978**

Radio Valves : Mains Valves in the [continental] **Alphabetic Series.**—K. I. Drozdoff. (*Radio, Moscow*, July/Aug. & Sept./Oct. 1946, Nos. 4/5 & 6/7, pp. 51–60 & 53–62. In Russian.) Tables of data, with possible equivalents.

621.385.1.032.216 **2979**

Oxide Cathodes. Their Experimental, Theoretical and Technical Development.—O. Weinreich. (*Rev. gén. Élect.*, Feb. 1947, Vol. 56, No. 2, pp. 75–90.) An account of progress from 1904 to 1944. Several theories of electronic emission processes are outlined. Developments associated with the construction of magnetrons are described. Experimental studies of the mechanism of emission by means of X rays, electron diffraction and pulse voltages are discussed. Pulse technique opens up a wide field for new investigations which may lead to an adequate theory.

621.385.1.072.2 **2980**

Characteristics of Certain Voltage-Regulator Tubes.—G. M. Kirkpatrick. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, pp. 485–489.) Characteristics and stability of a number of valves of types VR75, VR105 and VR150 are examined and an equivalent circuit determined. The results are of value when VR valves are used to provide reference potentials in electronic stabilizers.

621.385.3 : 621.396.813 **2981**

The Reduction of Microphonics in Triodes.—A. H. Waynick. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 239–245.) An analysis of the effect of grid displacement on the anode current of a planar triode.

621.385.3.029.63.015.33 **2982**

Development of Pulse Triodes and Circuit to give One Megawatt at 600 Megacycles.—R. R. Law, D. G. Burnside, R. P. Stone & W. B. Whalley. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 253–264.) A description of the development of the air-cooled A-2231 valve and its use in a push-pull oscillator circuit tuning over the range 560–640 Mc/s.

621.385.832 : 621.396.96 **2983**

War-Time Developments in Cathode-Ray Tubes for Radar.—L. C. Jesty, H. Moss & R. Puleston. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 149–166.) A review of the war-time history from the design point of view. For technical reasons, most of the tubes used for radar were electrostatic, little use being made of magnetic deflection. Progress in the design of tube envelopes, electron guns, bases, screens and deflection systems is discussed, with special reference to afterglow screens, rigidity and uniformity of construction, ability to withstand shock and vibration, and semi-mass-production methods. Testing procedures and tubes for particular applications are described, with illustrations of intensity-modulated and deflection-modulated displays and a comprehensive list of tube types.

621.385.832 : 621.396.96 **2984**

A Survey of Cathode-Ray-Tube Problems in Service Applications, with Special Reference to Radar.—G. Bradfield, J. G. Bartlett & D. S. Watson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 128–148.) R.A.F., Army and R.N. problems are considered separately. The special requirements associated with radar displays for air interception, air navigation, precision fire-control and the plan position indication of ships, aircraft, towns and shell splashes are reviewed. The need for large projected displays and for the dark-trace tube is discussed, with photography and visibility problems, which have an important bearing upon the choice of tube for a particular purpose. A number of practical applications are described and illustrated.

621.386.032.22 **2985**

Operations in the Production of Electronic Tube Components.—(*Machinery, N.Y.*, Feb. 1947, Vol. 53, No. 6, pp. 160–164.) Production methods are described for the rotating anode assembly for certain X-ray tubes.

621.396.615.141.2 **2986**

Theory of the Magnetron as Microwave Generator.—F. Lüdi. (*Helv. phys. Acta*, 20th Feb. 1946, Vol. 19, No. 1, pp. 1–20. In German.) For previous work see 3338 of 1943, 3531 of 1945 and 2354 of August. This article gives theory and experimental results for the multi-segment type of magnetron only.

621.396.615.141.2 **2987**

A Tunable Squirrel-Cage Magnetron — The Donutron.—F. H. Crawford & M. D. Hare. (*Proc. Inst. Radio Engrs, W. & E.*, April 1947, Vol. 35, No. 4, pp. 361–369.) The donutron is an all-metal multi-segment magnetron with a single resonant cavity. "It is tuned by the relative axial displacement of alternate anode segments, through flexure of one wall of the cavity in which the anode structure is supported." The best of 60 models tested can be tuned over a 1.5 to 1 frequency range (in the 6–12 cm waveband) with a single value of voltage and magnetic field. An efficiency of 40–50% was obtained, with a power output of about 50 W which was constant to 3 db over the tuning range. The various possible modes of operation and methods of suppressing or enhancing them are described.

621.396.615.141.2 **2988**

Technical Problems in the Manufacture of Cavity Magnetrons.—G. H. Bézy. (*Rev. gén. Élect.*, Feb. 1947, Vol. 56, No. 2, pp. 68–71.) Discusses the conditions which should be satisfied by anode, cathode and coupling system and describes methods of overcoming certain difficulties in their construction and final assembly.

621.396.615.141.2 **2989**

Space Charge Frequency Dependence of Magnetron Cavity.—W. E. Lamb, Jr, & M. Phillips. (*J. appl. Phys.*, Feb. 1947, Vol. 18, No. 2, pp. 230–238.) A theoretical investigation of the effect produced on the resonant frequencies of a magnetron cavity by the presence of a thin layer of charge surrounding the cathode.

621.396.615.142 **2990**

On the Conversion Efficiency of Velocity-Modulation Tubes of the Reflex Type.—J. Bernier. (*Ann. Radioélect.*, Oct. 1946, Vol. 1, No. 6, pp. 359–382.) For satisfactory efficiency the h.f. voltage should neither be so low that the electrons are not sufficiently checked on their return, nor so high that too much energy is required to control the forward beam. A quantitative study of the effects is made assuming that space-charge effects are negligible, electron trajectories rectilinear and the h.f. field uniform and well defined, though of finite magnitude. The conversion efficiency is calculated (*a*) for different values of the h.f. field supposing all electrons are reflected by the mirror and (*b*) when only half the electrons are reflected by a mirror at the potential of the cathode and the h.f. field is infinitely narrow.

621.396.615.142.2 **2991**

Practical Limitations of the Power and Efficiency of Two-Cavity Klystrons.—P. Guénard. (*Ann. Radioélect.*, Jan. 1947, Vol. 2, No. 7, pp. 13–23.) A discussion with certain simplifying assumptions. For this type of valve the efficiency decreases rapidly with increase of frequency from about 30% for the longer waves to zero for millimetre wavelengths. The h.f. power can exceed 1 kW at wavelengths above 10 cm, but decreases rapidly with increase of frequency and is only a few watts for a wavelength of 3 cm.

621.396.615.142.2 **2992**

Practical Limitations of the Power and Efficiency of Two-Cavity Klystrons.—P. Guénard. (*Onde élect.*, March 1947, Vol. 27, No. 240, pp. 94–103.) See 2991 above. The present paper gives a fuller discussion and includes appendices on (*a*) the efficiency of valves without grids and (*b*) the effects of space charge on longitudinal debunching.

621.396.615.142.2 **2993**

The Maximum Efficiency of Reflex-Klystron Oscillators.—E. G. Linder & R. L. Sproull. (*Proc. Inst. Radio Engrs, W. & E.*, March 1947, Vol. 35, No. 3, pp. 241–248.) "The theory of reflex-klystron oscillators is given in detail. It includes a discussion of relations in a loaded oscillator. It is shown that maximum efficiency for small amplitudes is given by $\eta_0 = 0.169M^2i_1/G_cV_0$, where M is the coefficient of modulation of the gap, i_1 is the effective current, G_c is the shunt conductance of the unloaded resonator, and V_0 is the beam voltage. Possibilities of increasing efficiency are considered, including effects of grid transmission on effective current and on space charge, and effects of multiple electron transits."

621.396.645 : 621.396.822 **2994**

Noise Factor : Part 3.—Moxon. (*See* 2919.)

MISCELLANEOUS

001.4 : [621.32.032.7 + 621.385.032.7 **2995**

Nomenclature System for Glass Bulbs.—Brann. (*See* 2975.)

62"1946" **2996**

Progress in Engineering Knowledge during 1946.—P. L. Alger, J. Stokley, F. H. Faust, E. L. Robinson, J. L. Tugman, W. W. Kuyper & W. D. Haylon. (*Gen. elect. Rev.*, March 1947, Vol. 50, No. 3, pp. 12–55.) A survey of developments in materials, techniques and design and application engineering, with an extensive bibliography.

620.1.05 **2997**

Ingenious New Testing Machine.—(*Overseas Engr*, April/May 1947, Vol. 20, No. 235, p. 320.) For tensile, compression, beam, shear and bending tests and also suitable for many precision pressing operations. Maximum load capacity 25 tons.

621.396 de Forest **2998**

Lee de Forest.—(*Radio Craft*, Jan. 1947, Vol. 18, No. 4, pp. 17–57..130.) A collection of papers describing the work of de Forest, with appreciations from prominent scientists and radio engineers, specially written to mark the 40th anniversary of his invention of the audion.

621.396 Tesla **2999**

Nikola Tesla (1856-1943).—F. Bedeau. (*Onde élect.*, Feb. 1947, Vol. 27, No. 239, p. 75.) A short account of his work on rotating fields and h.f. alternators and oscillators.

621.396.621(100.2) **3000**

Density of Radio Receivers throughout World.—(*Tele-Tech*, March 1947, Vol. 6, No. 3, p. 92.) A table giving the number of receiving sets per 100 population in 85 countries. See also 1588 of May.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.42 : 621.38 **3001**

A Method for Changing the Frequency of a Complex Wave.—Kent. (*See* 3048.)

534.62 : 621.396.001.42 **3002**

The Silent Room of the National Centre for the Study of Telecommunication.—P. Chavasse. (*C. R. Acad. Sci., Paris,* 12th May 1947, Vol. 224, No. 19, pp. 1341–1343.) A special arrangement of absorbing screens enables waves to be obtained which, in a test-space of 1.5 m^3, are uniform to within ± 1 db for all frequencies from 200 to 10 000 c/s.

534.756 **3003**

Acoustical Quanta and the Theory of Hearing.—D. Gabor. (*Nature, Lond.,* 3rd May 1947, Vol. 159, No. 4044, pp. 591–594.) A summary of the first two parts of 1057 of April with emphasis on the physical and physiological aspects of the problem.

534.78 : [621.396.619.11/.13 **3004**

Narrow-Band F.M. for Voice Communication.—Bishop. (*See* 3275.)

534.845 **3005**

Functional Sound Absorbers.—H. F. Olson. (*RCA Rev.,* Dec. 1946, Vol. 7, No. 4, pp. 503–521.) Sound absorbers are described whose high efficiency depends upon the shape and the fact that the absorbers are not required also to act as building material.

534.851 **3006**

The Reduction of Background Noise in the Reproduction of Music from Records.—H. H. Scott. (*Proc. nat. Electronics Conference, Chicago,* Vol. 2, pp. 586–596.)

534.86 : 534.322.1 **3007**

Experiments in Listening.—N. D. Webster & F. C. McPeak. (*Electronics,* April 1947, Vol. 20, No. 4, pp. 90–95.) Audience reaction to reproduced music, from both live and transcribed sources, is tested with a high-quality audio system.

534.861.1 **3008**

Acoustical Design of Studios for A.M. and F.M.—C. R. Jacobs. (*Tele-Tech,* June 1947, Vol. 6, No. 6, pp. 46–50.) Details of the lay-out and construction of the New York WNEW studios, with particulars of the insulation of floors, walls, ceilings, windows and doors. To minimize background noise, the air-conditioning system is lined throughout with rigid rockwool material 1 inch thick. A feature of the inner lining of the studios is that no large area of any one type of absorbing material is used. Five different types are used in combination with serrated and curved plywood and plaster areas.

534.861.1 **3009**

Audio Problems in A.M. Broadcasting.—H. L. Blatterman. (*Communications,* April 1947, Vol. 27, No. 4, pp. 18–21..51.) The subjective effect of a given broadcast depends not only on the characteristics of the electrical circuits between studio and home, but also on the reverberation introduced. An equipment interposed between the studio microphone and the transmitter is described which gives a controllable amount of reverberation.

The variation in high frequency transmission with the diameter of the playing groove in a disk recording may be compensated electrically. An arrangement for achieving this is described.

534.862.1 **3010**

Recording Studio 3A.—G. M. Nixon. (*RCA Rev.,* Dec. 1946, Vol. 7, No. 4, pp. 634–640.) The acoustical design problems encountered in remodelling a studio for recording both broadcast transcriptions and records for home use are discussed and some methods of solution given.

621.395.625 **3011**

Lateral Recording : Part 2.—W. H. Robinson. (*Communications*, April 1947, Vol. 27, No. 4, pp. 38–40, 58.) Discussion of cutter measurement technique, frequency run recordings, styli, cutting angles, disks, scratch filters and pre-emphasis. To be continued. For part 1 see 1993 of July.

621.395.625.2 **3012**

Embossing Type Sound Recorder.—(*Tele-Tech*, June 1947, Vol. 6, No. 6, p. 55.) Uses Vinylite disks of diameter $3\frac{3}{4}$ inches. These have a moulded guide groove, with 350 lines to the inch, on the underside and a sound groove is embossed on the smooth upper surface by a recording stylus which also serves for reproduction.

621.395.625.2 : 016 "1921/1947" **3013**

Bibliography of Disc Recording.—A. Jorysz. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 73–77, 104.) From 1921 to 1947, with brief summaries.

621.395.625.3 **3014**

Recent Developments in Magnetic Recording of Sound.—R. B. Vaile, Jr. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 597–602.)

AERIALS AND TRANSMISSION LINES

621.315.211.9 : 621.315.616.1 **3015**

Making Rubber Cables.—(*Elect. Rev., Lond.*, 22nd Aug. 1947, Vol. 141, No. 3639, pp. 278–283.) A description of the essential processes.

621.315.212 : 621.317.73.029.63 **3016**

Comparator for Coaxial Line Adjustments.—O. M. Woodward, Jr. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 116–120.) The instrument, consisting of a T-junction and rotating loop coupling to the lines, can be used in place of a slotted line and probe to measure standing-wave ratios and load impedances at u.h.f.

621.315.212 : 621.317.79 **3017**

A Standing-Wave Meter for Coaxial Lines.—Pattison, Morris & Smith. (*See* 3196.)

621.315.212.029.6 : [621.317.333 + 621.317.37 **3018**

The Voltage Characteristics of Polythene Cables.—Davis, Austen & Jackson. (*See* 3179.)

621.392 : 621.317.79 **3019**

The Theory and Design of Several Types of Wave Selectors.—N. I. Korman. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 404–423.) Wave selectors are devices which, when attached to a transmission line or waveguide, set up in another system a response proportional to either the forward or the backward travelling wave in the line or guide. Lumped-constant and distributed-constant wave selectors for frequencies lower and higher than 1 000 Mc/s respectively are described, with methods of adjustment.

621.392.029.64 **3020**

Wave Guides for Slow Waves.—L. Brillouin. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, p. 483.) Summary of Amer. Phys. Soc. paper. Pipes fitted with equidistant diaphragms, which behave as band-pass filters, show a very marked variation of phase velocity with respect to frequency.

621.392.029.64 : 549.623.5 **3021**

Mica Windows as Elements in Microwave Systems.—L. Malter, R. L. Jepsen & L. R. Bloom. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 622–633.) "The design of a virtually reflectionless, vacuum-tight window made of mica for use in a waveguide system is described. The technique of manufacture and the experimental results with a number of models are given. Such mica windows have many applications but are particularly useful for the transmission of microwave power or electromagnetic radiation in particular portions of the spectrum."

621.392.21 : 621.315.1+621.396.664] : 621.396.712 **3022**

The Design and Use of Radio-Frequency Open-Wire Transmission-Lines and Switchgear for Broadcasting Systems.—F. C. McLean & F. D. Bolt (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, pp. 216–217.) Discussion on 2139 of 1946.

621.392.43 **3023**

An Exponential Transmission Line employing Straight Conductors.—W. N. Christiansen. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 576–581.) The design is described of a 4-wire wide-band matching line, of constant wire diameter, in which the horizontal and vertical wire spacings vary linearly with distance to produce a characteristic impedance which rises nearly exponentially from 300 to 600 Ω.

621.392.43 **3024**

Matching the Line to the Ground-Plane Antenna.—J. T. McWatters. (*QST*, May 1947, Vol. 31, No. 5, pp. 56–58.) Simple calculations give the dimensions of the aerial and shunt corrective stub.

621.392.43 : [621.317.72.029.56/.58 **3025**

Additional Notes on the "Micromatch".—Jones & Sontheimer. (*See* 3188.)

621.396.67 **3026**

Problems in Wide-Band Antenna Design.—A. G. Kandoian. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 142.) Summary only. The most general requirement is that both the impedance and radiation patterns be essentially independent of frequency over the operating range, but in some specialized applications a predetermined variation of the radiation pattern with frequency is required. Examples and measured results of various types of wide-band aerial are discussed.

621.396.67 : 621.396.97 **3027**

Theoretical and Practical Aspects of F.M. Broadcast Antenna Design.—P. H. Smith. (*Communications*, March 1947, Vol. 27, No. 3, pp. 14–15.) Summary of 1947 I.R.E. Convention paper.

621.396.67 : 621.397.5 **3028**

Load Characteristics of Television Antenna Systems : Part 3.—Hamilton & Olsen. (*See* 3303.)

621.396.67 : 621.397.5 **3029**

Television Antenna Installations giving Multiple Receiver Outlets.—R. J. Ehret. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 26–29 . . 100.) A distribution system, for hotel use, with a single aerial. Three or six receivers are fed through 300-Ω lines without interference.

621.396.674 : 621.396.712 : 621.396.619.13 **3030**

Loop Antennas for F.M. Broadcasting : Part 1.—N. Marchand. (*Communications*, April 1947, Vol. 27, No. 4, pp. 34–35..63.) Discussion of aerial requirements for f.m., with particular reference to loop type aerials. To be continued.

621.396.676 **3031**

Aircraft Antenna Pattern Measuring System.—O. Schmitt. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 132.) Summary only. A system for drawing automatically the radiation patterns of aircraft aerials by use of scale models. See also 2684 of September (Schmitt & Peyser).

621.396.677 **3032**

Directional Patterns with a 54A Array.—H. R. Whaley. (*Radio News*, April 1947, Vol. 37, No. 4, pp. 53, 143.) Directional aerial arrays are described, using as elements standard single aerials whose horizontal radiation pattern is circular.

621.396.677 **3033**

Helical Beam Antenna.—J. D. Kraus. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 109–111.) Axial mode of operation gives circular polarization, with readily controlled directivity and gain. Aerial dimensions are given for λ 10 cm.

621.396.677 **3034**

Long Slot Antennas.—A. Alford. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 143–155.) Brief account of aerials with slot as long as possible and to which metal wings are added to control the radiation pattern in the plane perpendicular to the axis, and of the use of arrays of such aerials to obtain directivity.

621.396.96 : 621.396.82 **3035**

Theory of Radar Reflection from Wires or Thin Metallic Strips.—J. H. Van Vleck, F. Bloch & M. Hamermesh. (*J. appl. Phys.*, March 1947, Vol. 18, No. 3, pp. 274–294.) The radar reflecting properties of wires and thin metallic strips are analysed mathematically by two independent methods. The efficiency of a reflector is expressed by the concept of ‘ radar cross-section ’, defined as 4π times the power per unit solid angle returned in the direction of the source divided by the incident power density. This quantity, when expressed in units of area equal to the square of the wavelength, depends only on the ratios of the length of the wire to its diameter and to the wavelength. For several wires in random orientation an averaged ‘ radar cross-section ’ is calculated which is small when the wavelength is longer than the wire and passes through maxima when the wire is slightly less than an integral number of half wavelengths long. The ratio of maxima to minima decreases and their magnitude increases as the number of wavelengths of the wire increases. The values of the minima increase with the thickness of the wire. See also 1687 of June (Bloch, Hamermesh & Phillips).

CIRCUITS AND CIRCUIT ELEMENTS

538.3 : 621.396.694 : [621.385.029.63/.64 **3036**

On the Helix Circuit used in Progressive-Wave Valves.—É. Roubine. (*Onde élect.*, May 1947, Vol. 27, No. 242, pp. 203–208.) A complete account of the work referred to in 2339 and 2340 of August.

621.314.2.029.5 : 621.396.69 **3037**

Very-Wide Band Radio-Frequency Transformers.—D. Maurice & R. H. Minns. (*Wireless Engr*, June & July 1947, Vol. 24, Nos. 285 & 286, pp. 168–177 & 209–216.) Toroidal transformers may be used for impedance matching, balanced-unbalanced coupling, d.c. isolation and the provision of accurate voltage or current ratios. The equivalent circuit of the 2-winding transformer is used to deduce the l.f. loss ; the winding data for 2-db loss are shown graphically for various commercial cores (dust and alloy-strip). The leakage inductance and shunt capacitance for various forms of winding are evaluated ; their effect on the h.f. performance is minimized by a low-pass filter design technique. Multi-winding and auto-transformers are briefly discussed ; balance and its measurement are described. The design procedure is illustrated by a numerical example.

621.314.23 : 621.396.69 **3038**

Practical Transformer Design and Construction : Part 1.—C. Roeschke. (*Radio News*, June 1947, Vol. 37, No. 6, pp. 60–61..165.) Simple method of calculating winding data from graphs and tables.

621.314.26 : 629.135 **3039**

Electronic Frequency Changers for Aircraft.—O. E. Bowlus & P. T. Nims. (*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 463–466.) The frequency changer incorporates two distinct circuits : (*a*) power circuit for frequency conversion, and (*b*) control circuit to establish output frequency. Design and performance details of an experimental test unit are given. By using a similar unit with each alternator, several main aircraft engine-driven alternators can be operated in parallel.

621.314.671 **3040**

Circuit Cushioning of Gas-Filled Grid-Controlled Rectifiers.—D. V. Edwards & E. K. Smith. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, p. 1131.) Discussion on 361 of February.

621.315.2.011.3 **3041**

The Inductance of Wires and Tubes.—A. H. M. Arnold. (*J. Instn elect. Engrs*, Part I, Feb. 1947, Vol. 94, No. 74, pp. 116–118.) Summary of 1017 of April.

621.316.313.025 **3042**

A New Design for the A.C. Network Analyzer.—J. D. Ryder & W. B. Boast. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1162–1165.) Discussion on 362 of February.

621.316.726.029.64.078.3 **3043**

Microwave Frequency Stability.—Harrison. (See 3321.)

621.316.86 **3044**

Thermistors.—W. Rosenberg. (*Electronic Engng*, June 1947, Vol. 19, No. 232, pp. 185–187.) Discussion of characteristics and applications, including methods of use with ohmic resistors in amplifiers and oscillators.

621.318.323.2.042.15 **3045**

Permeability of Dust Cores.—Friedlaender. (See 3163.)

621.318.371.011.2/.4 **3046**

Q of Solenoid Coils.—M. V. Callendar. (*Wireless Engr*, June 1947, Vol. 24, No. 285, p. 185.) Within the limits of Medhurst's data (1694 of June) $Q = 0.15\sqrt{f}/(1/R + 1/l)$ is accurate within a few per cent provided $l > R$.

621.318.572 : 621.396.615.015.33 **3047**

Electronic Switch for the Production of Pulses.—C. R. Smitley & R. E. Graber. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 128–130.) A circuit providing variable pulse length and rate, variable delay of synchronizing pip and means for introducing a steady-state signal upon which pulses may be superimposed, in a laboratory generator.

621.38 : 534.42 **3048**

A Method for Changing the Frequency of a Complex Wave.—E. L. Kent. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 329–338.) A method retaining essentially the original waveform. Variants are obtained by different sampling procedures.

621.392.1 **3049**

On Methods for the Construction of Networks Dual to Non-Planar Networks.—A. Bloch. (*Proc. phys. Soc.*, 1st Nov. 1946, Vol. 58, No. 330, pp. 677–694.) A network having a non-planar circuit diagram (i.e. one with crossings between some of its branches) cannot be converted into its dual counterpart directly, but must first be converted to an equivalent planar network. The paper describes a number of methods for determining the equivalent planar network.

621.395.661 **3050**

Mica Capacitors for Carrier Telephone Systems.—A. J. Christopher & J. A. Kater. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1116–1117.) Discussion on 374 of February.

621.396.611.4 + 621.385.1 **3051**

F.M./TV P-A Tube and Grounded-Grid Cavity Circuit.—Wells & Reed. (*See* 3337.)

621.396.615 **3052**

Non-Linear Regenerative Circuits.—D. G. Tucker. (*Wireless Engr*, June 1947, Vol. 24, No. 285, pp. 178–184.) Analysis and curves for the frequency and amplitude discrimination of the synchronized oscillator with an unwanted signal mixed with the injected locking tone. Some discrimination occurs over the whole frequency range, and within limits a relatively pure tone can be obtained from a signal having other frequencies mixed with it that cannot be separated by ordinary frequency-selective circuits.

The experimental results of Byard & Eccles (750 of 1941) are shown to be consistent with the theory given.

621.396.615 : 371.66 **3053**

A Demonstration Valve Oscillator.—E. Bradshaw. (*Electronic Engng*, May 1947, Vol. 19, No. 231, pp. 162–163.) Meters in all parts of the circuit facilitate study of operating conditions of tuned-anode oscillator.

621.396.615.015.33 + 621.396.619.16 **3054**

Some Notes on Pulse Technique.—M. M. Levy. (*J. Brit. Instn Radio Engrs*, May/June 1947, Vol. 7, No. 3, pp. 99–116.) The transmission of pulses through ideal filters and delay lines is discussed in detail and practical formulae are given for the design of delay networks. The use of pulsed valves is considered together with methods of obtaining high efficiency in practical circuits for power pulse generators. Pulse modulation and demodulation processes are studied, with particular reference to the choice of conveniently shaped pulses, in order to simplify the circuit design and eliminate harmonic distortion.

621.396.615.12 : 621.396.619.13 **3055**

Frequency Modulation of High-Frequency Power Oscillators.—W. R. Rambo. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 577–585.) An account with particular reference to common-grid reactance-valve circuits and to class-C operation of reactance valves.

621.396.615.14 **3056**

Study of a V.H.F. Oscillator.—L. Liot. (*Télévis. franç.*, April 1947, No. 24, Supplement *Électronique*, pp. 11–14.) A detailed description of a symmetrical arrangement using two 955 valves with $\lambda/4$ lines feeding the anodes and between the cathodes and earth. Short-circuiting bars across these lines give wavelength adjustment from 0.7 m to 2 m.

621.396.615.142 : 621.396.621.54 : 621.396.96 **3057**

Reflex Oscillators for Radar Systems.—J. O. McNally & W. G. Shepherd. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 157.) Summary only. Design problems for oscillators for military radar receivers.

621.396.615.142.2 **3058**

Design of Wide-Range Coaxial-Cavity Oscillators using Reflex Klystron Tubes in the 1 000 to 11 000 Megacycle Frequency Region.—J. W. Kearney. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 624–636.) The design of an external-resonator type of reflex klystron oscillator, for use in standard signal generators and superheterodyne receivers. The tuning range is about 2 : 1 in frequency. Details of operation, and methods of adaptation of present day valves for use as coaxial resonators are given. Design characteristics are outlined for (*a*) optimum cavity dimensions, (*b*) suitable contacts to the valves, (*c*) non-contact, short circuiting tuning plungers, (*d*) output coupling devices. The factors involved in the choice of cavity and repeller modes, and precautions for the suppression of interference from undesirable modes, are discussed in some detail.

621.396.619 **3059**

Selective Demodulation.—D. B. Harris. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 565–572.) When an amplitude-modulated carrier f, together with other modulated carriers on frequencies harmonically related to f, is multiplied by the instantaneous value of a plain carrier whose frequency and phase are identical with f, only the modulation component of f appears in the output. The modulation components of two carriers in phase quadrature on the same frequency may be separated similarly. A suitable linear multiplicative pentagrid demodulator is described. The advantages and disadvantages of a system using these principles for multichannel carrier working are discussed, and a design for a hypothetical 8-channel system is outlined.

621.396.622 **3060**

F.M. Detector Systems.—B. D. Loughlin. (*Communications*, March 1947, Vol. 27, No. 3, p. 18.) Summary of 1947 I.R.E. Convention paper.

621.396.622 **3061**

A New Detector for Frequency Modulation.—Bradley. (*See* 3264.)

621.396/.397].645 **3062**

Bandwidth and Speed of Build-Up as Performance Criteria for Pulse and Television Amplifiers.—D. G. Tucker. (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, pp. 218–226.) "A comparison is made of the two main methods of describing the performance of pulse and television amplifiers, namely bandwidth, and speed of build-up of a suddenly-applied signal. It is shown for a variety of circuit arrangements (including asymmetrical circuits) that equal speeds of build-up based on the slope of the build-up curve at half the steady-state amplitude correspond fairly closely to equal bandwidths measured between the points at which the response is 3 db below that at the applied frequency. It is therefore concluded that either of these criteria would be satisfactory in practice, since they are mutually consistent. Other methods of defining the speed of build-up are discussed, and the main inconsistency is shown to be that, for only one or two stages, but not for larger numbers, the use of the maximum slope of the build-up curve gives misleading results."

621.396.645 **3063**

Stabilised Amplifiers.—J. J. Zaalberg van Zelst. (*Philips tech. Rev.*, Jan. 1947, Vol. 9, No. 1, pp. 25–32.) Two groups of circuits are discussed. The first adds a compensating quantity to the input or output signal of the main amplifier and uses either a negative feedback circuit or an auxiliary amplifier. The second group uses an auxiliary alternating voltage, generated either outside or inside the amplifier and passed through the same circuit as the main signal to keep the slope of the amplifying valve constant.

621.396.645 **3064**

Input Admittance of Cathode-Follower Amplifiers.—H. J. Reich. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 573–576.) General expressions are derived, taking the valve interelectrode capacitances into account, and curves of conductance and susceptance for typical valve constants are given. It is shown that capacitance across the cathode load resistance can produce a negative input conductance, and oscillations may result. Means of preventing such oscillations are discussed.

621.396.645 : 518.3 **3065**

Exact Design and Analysis of Double- and Triple-Tuned Band-Pass Amplifiers.—M. Dishal. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 606–626.) Nomograms for designing double and triple-tuned coupled circuits to achieve desired band-pass, gain, skirt-rejection, and phase-change characteristics are developed from conventional theory. Both inductive and capacitive coupling are considered. The work is extended to cover multistage band-pass amplifiers.

621.396.645 : 518.4 **3066**

A Graphical Analysis of the Cathode-Coupled Amplifier.—M. S. Rifkin. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 16..43.)

621.396.645.029.6 + 621.396.621.54.029.6 **3067**

Gain and Sensitivity of Amplifier and Frequency-Changer Stages for Metre and Decimetre Waves.—M. J. O. Strutt. (*Onde élect.*, May 1947, Vol. 27, No. 242, pp. 184–193.) Methods are given for estimating the optimum gain for both narrow and wide frequency bands. For narrow bandwidths the optimum gain is equal to the square of the effective slope divided by the product of the effective input and output admittances. For wide bands the admittance product must be replaced by that of the input and output capacitances. The power gain of amplifiers with grid coupling is treated in detail. Three important properties of the noise factor are stated ; these form a basis for applications which enable the noise factor to be reduced considerably, especially in the case of grid-coupling stages and multi-grid frequency changers.

621.396/.397].645.029.62 **3068**

Wide-Band I.F. Amplifier above 100 Mc/s.—M. T. Lebenbaum. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 25, 50.) Summary of Rochester Fall Meeting paper. A brief outline of the general features and design considerations. The advantages of staggered tuning and the effect of grid-anode capacitance are discussed. For the full paper see *Electronics*, April 1947, Vol. 20, No. 4, pp. 138–141.

621.396.645.029.62 **3069**

A Compact Lightweight Amplifier for Radar.—P. L. Hammann. (*Bell Lab. Rec.*, April 1947, Vol. 25, No. 4, pp. 146–149.) Design and construction details of the 6AK5 amplifier used in AN/APS-4 radar equipment and in the Bat radar-directed bomb.

621.396.645.029.62.076.2 **3070**

A Permeability-Tuned 100-Mc/s Amplifier of Specialized Coil Design.—Z. Benin. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 548–556.) Suitable spacing of coil turns and choice of core and coil lengths reduces frequency drift and makes trimmer capacitors unnecessary.

621.396.645.371.029.4 **3071**

The Parallel-T Bridge Amplifier.—A. B. Hillan. (*J. Instn elect. Engrs*, Part I, April 1947, Vol. 94, No. 76, pp. 188–189.) Summary of 2051 of July.

621.396.662 **3072**

The Design of Band-Spread Tuned Circuits for Broadcast Receivers.—D. H. Hughes. (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, p. 227.) Discussion on 1803 of 1946.

621.396.662.2 : 621.397.62 **3073**

Variable Inductance Tuning for TV Receivers.—M. F. Melvin. (*Communications*, April 1947, Vol. 27, No. 4, pp. 48–49, 63.) Description of a 3-gang tuning unit and its application in a television receiver covering the frequency range 44–216 Mc/s. Methods of adjusting the design to provide tracking and suitable bandwidths are described.

621.396.662.3 **3074**

The Design of Resonant Filters.—S. Y. White. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 56–57.) Discussion of pendulum analogy results in tuned filter with rapid rise, immunity from shock excitation and complete cut-off at 7% off resonance.

621.396.662.3 : 534.12 **3075**
Compact Electromechanical Filter.—R. Adler. (*Electronics,* April 1947, Vol. 20, No. 4, pp. 100–105.) The design and performance of a transmission-line type of filter consisting of a number of steel plates interconnected by steel wires. A model for a 455-kc/s i.f. channel is described.

621.396.662.34 : 621.396.645.37 **3076**
RC Bandpass Filter Design.—J. L. Powers. (*Electronics,* April 1947, Vol. 20, No. 4, pp. 131–133.) Design curves and applications to l.f. filters of a parallel-T RC network, used as the feedback loop in an amplifier to give narrow bandpass characteristics similar to those of an LC circuit.

621.396.69 + 621.317.7 + 621.38 **3077**
The Physical Society's Exhibition.—(*Electronic Engng,* June 1947, Vol. 19, No. 232, pp. 195–198.) See also 2494 of August.

621.396.69 + 621.317.7 **3078**
The R.C.M.F. [Radio Component Manufacturers' Federation] **Exhibition.**—(*Electronic Engng,* May 1947, Vol. 19, No. 231, pp. 164–165.) A further selection of exhibits. See also 2376 of August.

621.396.69 **3079**
Electronic Wiring Techniques.—C. Brunetti. (*Communications,* March 1947, Vol. 27, No. 3, p. 16.) Summary of 1947 I.R.E. Convention paper.

621.396.69 **3080**
Evolution of Printed Circuits for Miniature Tubes.—A. F. Murray. (*Tele-Tech,* June 1947, Vol. 6, No. 6, pp. 58–61 . . 112.)

621.396.69 **3081**
Materials and Techniques for Printed Electrical Circuits.—Rose. (*See* 3164.)

621.396.69 : 669.228 **3082**
New Types of Silver Coatings.—Hopf. (*See* 3166.)

621.396.96 : 531.76 **3083**
Timer for Radar Echoes.—L. A. Meacham. (*Bell Lab. Rec.,* June 1947, Vol. 25, No. 6, pp. 231–236.) A range measuring unit for radar systems which use irregularly spaced pulses. Each transmitted pulse initiates a sine wave reaching steady state immediately. This is passed through a continuously variable phase shifter and is formed into pulses, one of which is selected as a marker. By means of the phase shifter control, which is calibrated in distance, the marker can be continuously moved over the radar display.

GENERAL PHYSICS

531.18 : 531.15 **3084**
Absolute Rotation and a Rotating Magnet.—Chang-Pen Hsü. (*Wireless Engr,* June 1947, Vol. 24, No. 285, pp. 185–187.) Comment on 3564 of 1946 (G.W.O.H.); see also 2727 of September (Stedman) and back reference. Einstein's principle of equivalence, properly applied for any particular instant, gives a simple explanation of so-called 'absolute rotation'. The electromagnetic reaction upon a rotating magnet and the resultant electric field distribution in it can then be obtained from Maxwell's equations modified for the relativity effect.

537.291 : 621.385.833 **3085**
Oil-Drop Method for Electron Trajectories.—L. Jacob. (*Nature, Lond.,* 5th April 1947, Vol. 159, No. 4040, pp. 475–476.) Visual study of trajectories in air at atmospheric pressure of charged oil-drops falling under gravity through enlarged model of electrostatic electron lens.

537.311.33 **3086**
Surface States and Rectification at a Metal Semi-Conductor Contact.—J. Bardeen. (*Phys. Rev.,* 15th May 1947, Vol. 71, No. 10, pp. 717–727.)

537.312.62 **3087**
Super-Conductivity.—E. Schroter. (*Metal Ind., Lond.,* 13th June 1947, Vol. 70, No. 24, pp. 444–445.) A review of recent researches, abstracted from *Zentralblatt für die österr. Industrie und Technik,* discussing (*a*) the critical temperatures of pure metals, alloys and certain metallic compounds such as nitrides, carbides, etc., (*b*) the transition from normal conductivity to super-conductivity and (*c*) the effects produced in super-conducting materials by the application of a magnetic field. A result of practical importance has been the discovery of materials with critical temperatures in the region of the temperature of boiling hydrogen. Further research may reveal substances with critical temperatures easily attained.

537.312.62 **3088**
The Magnetic Quenching of Superconductivity.—J. W. Stout. (*Phys. Rev.,* 15th May 1947, Vol. 71, No. 10, p. 741.)

537.523.3 **3089**
The Mechanism of the Negative Point Corona at Atmospheric Pressure in Relation to the First Townsend Coefficient.—L. B. Loeb. (*Phys. Rev.,* 15th May 1947, Vol. 71, No. 10, pp. 712–714.)

537.525 : 621.3.015.5.027.7 **3090**
The Insulation of High Voltages in Vacuum.—J. G. Trump & R. J. Van de Graaff. (*J. appl. Phys.,* March 1947, Vol. 18, No. 3, pp. 327–332.) A description of research into the mechanism of electrical breakdown in vacuum for voltages from 50 kV to 700 kV. Results are given graphically supporting a theory of breakdown at these voltages due to secondary emission. See also 3575 of 1946.

538.3 **3091**
The Experimental Basis of Electro-Magnetism : The Direct-Current Circuit.—N. R. Campbell & L. Hartshorn. (*Proc. phys. Soc.,* 1st Nov. 1946, Vol. 58, No. 330, pp. 634–653.) The first part of an investigation of the extent to which the working principles of electromagnetism can be soundly based on real experimental facts as distinct from imaginary experiments such as those involving point charges and unit magnetic poles.

The general principles of measurement are outlined. Current, resistance, conductance and voltage are then established independently of a knowledge of any other magnitudes. Ohm's Law and the conception of e.m.f. follow. An examination of the relations between these magnitudes and geometrical and mechanical magnitudes leads to the consideration of Ampère's two laws. See also 3092 below.

538.3 **3092**
The Experimental Basis of Electromagnetism.—G.W.O.H. (*Wireless Engr*, June 1947, Vol. 24, No. 285, pp. 161–162.) Editorial discussion of 3091 above.

538.52 : 537.123 **3093**
On a New Electromagnetic Induction Effect due to Negative Ions.—T. V. Ionescu & V. P. Mihu [Mihul]. (*C. R. Acad. Sci., Paris*, 12th May 1947, Vol. 224, No. 19, pp. 1349–1351.) If a Geissler tube is placed within a coil forming part of an oscillatory circuit, the intensity of the current through the coil varies with the intensity of the tube current. A detailed study of this effect is described. In general an absorption of energy occurs in the discharge tube, but for certain frequencies the resonator current is much greater with the discharge than without it.

538.56 : [621.396.615.142 + 621.392.029.64 **3094**
Generalized Boundary Conditions in Electromagnetic Theory.—S. A. Schelkunoff. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 317–322.) Generalization of the conception of an idealized perfectly conducting boundary, and its application to waveguides, magnetrons and velocity-modulation valves. The generalized condition is that E_t/H_t is constant, E_t and H_t being the tangential components of the electric and magnetic vectors at a given surface. The condition may be extended to distinguish between isotropic and anisotropic boundaries, and the ratio E_t/H_t may be a given function of position on the boundary.

538.566.2 : 517.94 **3095**
Two Notes on Phase-Integral Methods.—W. H. Furry. (*Phys. Rev.*, 15th March 1947, Vol. 71, No. 6, pp. 360–371.) In the first note, entitled 'A New Derivation of the Connection Formulas', proof is based only on the fact that actual solutions of the differential equation must be single-valued. The results serve to establish the validity of Eckersley's phase-integral method for the treatment of problems of wave propagation. The second note, entitled 'Normalization of Approximate Wave Functions of the Anharmonic Oscillator', discusses the accuracy of the usual asymptotic formula for the normalization factor for the lowest quantum states of the oscillator.

538.569.4.029.64 : 546.171.1 **3096**
Inversion Spectrum of Ammonia.—M. W. P. Strandberg, R. Kyhl, T. Wentink, Jr, & R. E. Hillger. (*Phys. Rev.*, 1st March 1947, Vol. 71, No. 5, p. 326.) Measurements of the frequencies of some of the lines have been made to an accuracy of ± 50 kc/s. A formula for these frequencies in terms of rotational angular momenta is discussed. See also 1399 of May (Townes) and back references, and 3097 below.

538.569.4.029.64 : 546.171.1 **3097**
Microwave Absorption Frequencies of $N^{14}H_3$ and $N^{15}H_3$.—W. E. Good & D. K. Coles. (*Phys. Rev.*, 15th March 1947, Vol. 71, No. 6, pp. 383–384.) Measurements of the frequencies of some of the lines to an accuracy of ± 20 kc/s. See also 3096 above.

538.569.4.029.64 : 546.21 **3098**
The Absorption of Microwaves by Oxygen.—J. H. Van Vleck. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, pp. 413–424.) A theoretical paper in which the features of the oxygen absorption spectrum at millimetre and centimetre wavelengths are derived and compared with existing experimental data. The absorption is caused by the interaction of the magnetic moment of O_2 with electromagnetic fields, and is most pronounced at a wavelength of about 5 mm where it exceeds 10 db/km. The theoretical dependence of absorption on pressure is considered.

538.569.4.029.64 : [546.212 + 546.212.02 **3099**
Expected Microwave Absorption Coefficients of Water and Related Molecules.—G. W. King, R. M. Hainer & P. C. Cross. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, pp. 433–443.) A theoretical paper. The predicted positions and strengths of the absorption lines at centimetre and millimetre wavelengths are tabulated for H_2O, D_2O, HDO, H_2S, and H_2Se, and, where possible, compared with experimental data. It is pointed out that HDS and HDSe will also have many absorption lines in this wavelength region. See also 3100 below.

538.569.4.029.64 : 546.212 **3100**
The Absorption of Microwaves by Uncondensed Water Vapor.—J. H. Van Vleck. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, pp. 425–433.) A theoretical paper in which the characteristics of the absorption spectrum at centimetre and millimetre wavelengths are computed and compared with existing experimental data. Agreement is generally satisfactory and the comparison yields precise information concerning the wavelength and breadth of the absorption line at about 1.35 cm (attenuation 0.2 db/km per gm/m^3). The predicted attenuation " due to the combined effect of all the other lines, whose wavelengths are too short for resonance " is about a quarter of the observed value; possible explanations of this discrepancy are discussed. See also 3099 above.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.11 **3101**
Meteor Detection by Amateur Radio.—O. G. Villard, Jr. (*QST*, July 1947, Vol. 31, No. 7, pp. 13–18.) A general explanation of the effect of meteors on radio propagation, and an account of experimental equipment used for their detection.

523.7 + 550.385]"1946.10/.12" **3102**
Solar and Magnetic Data, October to December, 1946, Mount Wilson Observatory.—S. B. Nicholson & E. S. Mulders. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 65–66.)

523.72 + 523.32] : 621.396.822.029.64 **3103**
Microwave Radiation from the Sun and Moon.—R. H. Dicke & R. Beringer. (*Astrophys. J.*, May 1946, Vol. 103, No. 3, pp. 375–376.) Measurement of thermal radiation at 1.25 cm; half-power beam width of 18-inch parabolic reflector was 2° and measured gain 6 000 times that of isotropic radiator. Size of sun's disk at 1.25 cm found to be nearly similar to that at optical wavelengths; effective black-body temperature of sun and moon found to be about 1.1×10^4 and 292°K respectively.

523.72 : 621.396.822 **3104**

Origin of Solar 'Static'.—C. E. R. Bruce. (*Nature, Lond.*, 26th April 1947, Vol. 159, No. 4043, p. 580.) Comment on 2088 of July (Martyn). Suggestion that "discharges occur in the radial electric field set up by the emission of highly charged atoms from nuclear reactions in the sun's interior".

523.74 : 551.593.9 **3105**

Relations between Solar Activity and the Luminescence of the Earth's Upper Atmosphere.—J. Cabannes, J. Dufay & Tcheng Mao-Lin. (*C. R. Acad. Sci., Paris*, 19th May 1947, Vol. 224, No. 20, pp. 1393–1395.)

523.746 "1946.10/.12" **3106**

Provisional Sunspot-Numbers for October to December, 1946.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, p. 14.)

523.746 "1947.03/.04" **3107**

Solar Notes.—H. W. N. (*Observatory*, April 1947, Vol. 67, No. 837, p. 74.) Two sunspots occurred in March and April 1947 without associated magnetic storms. The April spot was the largest ever recorded.

523.78 "1945.07.02" : 621.396.822.029.64 **3108**

Radio Noise from the Sun at 3.2 cm.—K. F. Sander. (*Nature, Lond.*, 12th April 1947, Vol. 159, No. 4041, pp. 506–507.) Comment on 716 of March (Martyn). Observations during the partial eclipse of July 2, 1945 indicate that the noise mainly emanates from the solar circumference and has a value of 4×10^{-18} W/cm^2 per Mc/s.

523.78 "1947.05.20" : 551.510.535 **3109**

To the Question of the Coefficient of the Ionosphere's Recombination and the Determination of Its Quantity at the Time of the Eclipse on the 20th of May 1947 in Brazil.—J. L. Alpert & A. A. Einberg. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1947, Vol. 11, No. 2, pp. 137–140. In Russian with English summary.) Measurements at Tromse during the eclipse of 9th June 1945 gave for the effective recombination coefficient of the E layer : $\alpha_E = 4.65 \times 10^{-9}$ and for the F_1 layer : $\alpha_{F_1} = 6.9 \times 10^{-9}$. The changes of ionization to be expected during the 1947 eclipse are calculated.

537.591 **3110**

Cosmic-Ray Research in B-29 Laboratory determines Nature of Secondary Particles.—G. Grosvenor. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 84–87.) Proof that a large proportion of mesotrons is produced by electrically-charged particles.

537.591 **3111**

The Mass of the Mesotron as determined by Cosmic-Ray Measurements.—D. J. Hughes. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, pp. 387–392.) "The great majority of the results are statistically reconcilable with a single mass."

538.12 : 521.15 **3112**

The Magnetic Field of Massive Rotating Bodies.—P. M. S. Blackett. (*Nature, Lond.*, 17th May 1947, Vol. 159, No. 4046, pp. 658–666.) It is known that the magnetic moment and the angular momentum of the earth and sun are nearly proportional and that the constant of proportionality is nearly the square root of the gravitational constant divided by the velocity of light. The author points out that recent measurements of the magnetic moment of a star are in agreement with this relationship and that since its validity has been demonstrated over such a wide range of values of the parameters it should be given further consideration as a possible general law of nature. A review of previous theories of the magnetic field of the earth and sun is followed by a discussion of the application of the above relationship and of the possibilities of further measurements both for stars and in the laboratory.

550.38 "1884/1889" **3113**

Daily International Magnetic Character-Figures, *C*, for the Years 1884 to 1889.—J. Bartels. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 33–38.)

550.38 "1945" **3114**

Mean *K*-Indices from Thirty Magnetic Observatories and Preliminary International Character-Figures, *C*, for 1945.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 25–31.)

550.38 "1946.04/.06" **3115**

Five International Quiet and Disturbed Days for April to June, 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, p. 87.)

550.38 "1946.10/.12" **3116**

American Magnetic Character-Figure, C_A, Three-Hour-Range Indices, K, and Mean K-Indices, K_A, for October to December, 1946, and Summary for Year 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 15–24.) See also 1770 of June.

550.385 : 523.755 "1942.08/1944.07" **3117**

The Correlation of Magnetic Disturbances with Intense Emission Regions of the Solar Corona.—A. H. Shapley & W. O. Roberts. (*Astrophys. J.*, May 1946, Vol. 103, No. 3, pp. 257–274.) Observations during 1942–1944 show that magnetic disturbance occurred when intense emission regions of the corona were situated in the eastern hemisphere of the solar disk.

550.385 : 621.396.11 **3118**

Effect of Magnetic Perturbations on the Velocity of Short Radio Waves.—Stoyko. (*See* 3251.)

551.5 : 621.396.9 **3119**

Recent Developments in Meteorological Equipment.—A. F. Spilhaus. (*Bull. Amer. met. Soc.*, Sept. 1946, Vol. 27, No. 7, pp. 399–409.) A review of wartime developments in electronic and other equipment for use both in aircraft and on the ground.

551.510.535 **3120**

The Ionosphere.—(*Observatory*, April 1947, Vol. 67, No. 837, pp. 51–53.) Sir Edward Appleton, introducing a geophysical discussion, pointed out that though the general structure of the ionosphere is well known, anomalies occur, especially in the F_2 layer with its winter ionization maximum and dependence on magnetic dip (see 2898 of 1946). A. H. Mumford described transatlantic experiments on the reciprocity of long distance transmission, and H. L. Kirke experiments on lateral deviation between London and New Delhi. J. W. Cox described work by the Interservice Ionosphere Bureau on possible ways of using existing knowledge. J. S. Hey considered radiations associated with solar disturbances at wavelengths between

1.5 and 15 m. 'Scatter bursts' were discussed; they occur at a height of about 95 km and are believed to originate from meteors. Finally, H. S. W. Massey considered the processes by which the ionospheric layers are formed.

551.510.535 **3121**

Ionospheric Studies in South Africa: Telecommunications Research Laboratory Ionospheric Sounder.—T. L. Wadley. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 67–69.) A description of the ionospheric recorder in use at Johannesburg. The instrument covers the frequency range of 2–15 Mc/s in 8 seconds. The height/frequency graph is formed on a long-afterglow c.r. tube and photographed on a single frame of 16-mm film. The transmitter and receiver are kept in tune by means of a common oscillator, and the r.f. tracking is obtained by cams which operate the tuning capacitors.

551.510.535 **3122**

Echoes at *D*-Heights with Special Reference to the Pacific Islands.—C. D. Ellyett. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 1–13.) Radio echoes obtained from an equivalent height of 50 km above Pitcairn Island during 1944 and 1945 by the usual vertical-incidence pulse technique are attributed to D-layer reflections. Earlier data are collected and compared with these observations, which are analysed with respect to frequency range, diurnal and seasonal variations and echo strength.

551.510.535 **3123**

Temperature of the Upper Atmosphere.—S. L. Seaton. (*Phys. Rev.*, 15th April 1947, Vol. 71, No. 8, p. 557.) Calculations are made of the temperature at various heights for three widely different latitudes. At E-layer heights of about 100 km, high temperatures are to be expected, while the F_1 and F_2 layers at about 200 km and 350 km respectively may be at considerably lower temperatures, with a wide variation from night to day.

551.510.535 : 621.396.11 **3124**

Equivalent Path and Absorption in an Ionospheric Region.—Jaeger. (*See* 3252.)

551.510.535 : 621.396.11.029.58 **3125**

Doppler Effect in Propagation.—Griffiths. (*See* 3254.)

551.593.5 **3126**

The Equilibrium of Atmospheric Sodium [Na–Na$^+$ and Na–NaO].—D. R. Bates. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 71–75.)

551.593.9 + [551.510.535 : 523.7 **3127**

[Minutes of the] **Meeting of the Royal Astronomical Society** [14th March 1947].—(*Observatory*, April 1947, Vol. 67, No. 837, pp. 46–51.) Short papers read and discussed included: The Origin of the Night Sky Light, by D. R. Bates, and The Relations between the Ionosphere, Sunspots and Solar Corona, by K. O. Kiepenheuer (an account by R. d'E. Atkinson).

LOCATION AND AIDS TO NAVIGATION

621.396.663 **3128**

4-Band Automatic Radio Direction Finder for Transport Planes.—R. H. Bailey. (*Radio News*, June 1947, Vol. 37, No. 6, pp. 68–69 . . 130.) An account of a new light-weight radio compass covering all normal broadcast transmissions and marine beacons. Improved bearings are obtained because the compass loop is automatically turned to face the incoming signal. High altitude and atmosphere effects are reduced by hermetic sealing of components and eliminating the receiver power pack.

621.396.9 : 551.5 **3129**

Applications of Electronics to Meteorology.—C. M. Reber. (*Bull. Amer. met. Soc.*, Sept. 1946, Vol. 27, No. 7, pp. 365–372.) A brief account of the application of radar to the detection of thunderstorms, fronts and other precipitation areas, and also to the following of free balloons for wind determination. The use of the cathode-ray direction finder to obtain the position of sources of atmospherics is also described.

621.396.9 : 551.5 **3130**

Recent Developments in Meteorological Equipment.—Spilhaus. (*See* 3119.)

621.396.93 **3131**

Raydist — A Radio Navigation and Tracking System.—C. E. Hastings. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 30–33 . . 103.) A portable system depending on the relative phase relationship between c.w. transmitters operating on frequencies of the order of 2–15 Mc/s. Block diagrams show the arrangement of equipment at the master and relay stations for (*a*) determining the position of a ship or an aeroplane, (*b*) measuring the distance between two stations, and (*c*) charting the flight path of a guided missile.

621.396.93 : 551.594.6 **3132**

Location of Thunderstorm Centres from Directional Observations of Atmospherics during Sunrise and Sunset.—S. R. Khastgir, M. K. Das Gupta & D. K. Ganguli. (*Nature, Lond.*, 26th April 1947, Vol. 159, No. 4043, pp. 572–573.) The time variation of the intensity of atmospherics is in agreement with the theory of Khastgir (1379 of 1943) and enables the difference of the longitudes of the source and receiver to be estimated.

621.396.93 : 621.396.663 **3133**

The Design of Electromagnetic Radiogonimeters for Use in Medium-Frequency Direction-Finding.—J. H. Moon. (*J. Instn elect. Engrs*, Part I, April 1947, Vol. 94, No. 76, pp. 185–196.) Summary of 2127 of July.

621.396.932 **3134**

Radio Aids to Marine Navigation.—(*Nature, Lond.*, 10th May 1947, Vol. 159, No. 4045, p. 647.) Brief description of the International Meeting, London, May 1946, during which ship and shore d.f., hyperbolic systems (Loran, Gee, Decca) and radar were discussed. For the complete account see 3135 below.

621.396.932 **3135**

Radio Aids to Marine Navigation. Vol. 1. Record of the [international] **Meeting held in London** [in May 1946] **and of Demonstrations and Visits. Vol. 2. Radio Navigation Radar and Position Fixing Systems for Use in Marine Navigation.** [Book Notice]—H.M. Stationery Office. Vol. 1, 2s. 6d. Vol. 2, 5s. (*Govt. Publ., Lond.*, Nov. & Dec. 1946, p. 16 & p. 16.)

621.396.932 **3136**

Postwar Marine Radar in Great Britain.—M. G. Scroggie. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 9–11, 41.) The design of the prototype set developed by the British Admiralty and demonstrated at the international meeting on Radio Aids (3135 above). Choice of frequency, pulse duration, horizontal and vertical beam widths, transmitter power and performance monitoring are discussed in some detail. New design features include facilities for superimposing the p.p.i. picture upon charts and a monitoring device which indicates voltages at 20 points as vertical lines on the display tube. A safety device automatically cuts out the p.p.i. should the performance of either transmitter or receiver fall below a certain level.

621.396.933 **3137**

Trends in Air Navigation.—H. Davis & L. Lader. (*Communications*, March 1947, Vol. 27, No. 3, pp. 15–16.) Summary of 1947 I.R.E. Convention paper.

621.396.933 **3138**

Teleran.—D. H. Ewing & R. W. K. Smith. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 601–621.) A system for air navigation and traffic control using television and radar. See also 3139 below.

621.396.933 **3139**

Teleran Air Navigation and Traffic Control by Means of Television and Radar.—D. H. Ewing & R. W. K. Smith. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 299–316.) See also 1546 of 1946 (Herbst et al.) and 3138 above.

621.396.933 **3140**

Navaglobe Long-Range Radio Navigation System.—P. R. Adams & R. I. Colin. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 288–298.)

621.396.933 : 629.135 **3141**

Automatic Radio Flight Control.—F. L. Moseley & C. B. Watts. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 268–287.) An outline of various radio navigational facilities for automatic aircraft guidance.

621.396.933.029.5/.6 **3142**

Ground-Air Communications Unit.—Meacham. (*See* 3325.)

621.396.933.2 **3143**

Improvements in 75-Megacycle Aircraft Marker Systems.—B. Montgomery. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 133–141.)

621.396.96+621.396.93 **3144**

A Survey of the Development of Radar.—R. A. Smith. (*J. Instn elect. Engrs*, Part I, April, 1947, Vol. 94, No. 76, pp. 172–178.)

621.396.96 : 531.76 **3145**

Timer for Radar Echoes.—Meacham. (*See* 3083.)

621.396.96 : 621.396.82 **3146**

Theory of Radar Reflection from Wires or Thin Metallic Strips.—Van Vleck, Bloch & Hamermesh. (*See* 3035.)

621.396.96 : 629.135 **3147**

Radar Eyes for the Black Widow.—J. B. Maggio. (*Bell Lab. Rec.*, June 1947, Vol. 25, No. 6, pp. 221–226.) Describes a night fighter radar system. A dipole rotating in a parabolic mirror scans a 15° cone. The mirror searches automatically or can be directed by the radar operator on to a chosen aircraft which it then follows, ignoring aircraft at different ranges. Indication is given to the pilot of range, azimuth and rate of overtaking.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 : 535.215.9 **3148**

The Influence of Irradiation with Light on the Dielectric Properties of ZnS Phosphors.—W. de Groot. (*Philips tech. Rev.*, Dec. 1946, Vol. 8, No. 12, p. 370.) Brief summary of *Physica* paper. The change in dielectric behaviour is probably due to free electrons.

537.312.62 : 546.883 **3149**

Magnetic Transition Curves in Superconducting Tantalum.—R. T. Webber. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, p. 471.) Summary of Amer. Phys. Soc. paper on the results of measurements made at the temperature of liquid helium with thin wires of pure tantalum in uniform longitudinal magnetic fields. Unannealed wires were used and the effects of annealing and outgassing were also determined. Experiments with pulse magnetic fields are mentioned.

538.221 **3150**

On the Isothermal Remanent Magnetization of Iron Sesquioxide.—J. Roquet. (*C. R. Acad. Sci., Paris*, 19th May 1947, Vol. 224, No. 20, pp. 1418–1420.) Measurements on stabilized $\mathrm{Fe_2O_3}\alpha$ to field strengths of 32 300 gauss.

538.221 **3151**

Properties of a Fine-Grain Cubic Ferromagnetic Material.—L. Néel. (*C. R. Acad. Sci., Paris*, 28th May 1947, Vol. 224, No. 21, pp. 1488–1490.) See also 3152 below. Calculation for spherical grains shows that below a critical diameter of about 300 Å the magnetization is uniform. Powders have been obtained with a grain size of 200–300 Å and coercive field as high as 1 000 gauss; this field is too large to be satisfactorily explained by magnetocrystalline anisotropy and must probably be attributed to anisotropy of grain shape. Discussion of powders consisting of ellipsoids of different eccentricities confirms this view.

538.221 **3152**

The Coercive Field of a Cubic Ferromagnetic Powder with Anisotropic Grains.—L. Néel. (*C. R. Acad. Sci., Paris*, 2nd June 1947, Vol. 224, No. 22, pp. 1550–1551.) Abstracted with 3151 above.

538.221 : 621.317.41.029.62 **3153**

Ferromagnetism at Very High Frequencies: Part 1 — Magnetic Iron at 200 Mc/s.—Johnson, Rado & Maloof. (*See* 3182.)

538.221 : 621.317.41.029.62 **3154**

Complex Permeability of Magnetic Iron at 200 Mc/s as a Function of Polarizing Field.—Rado, Johnson & Maloof. (*See* 3183.)

538.245 : 621.318.323.2 **3155**

Non-Metallic Magnetic Material for High Frequencies.—J. L. Snoek. (*Philips tech. Rev.*, Dec. 1946, Vol. 8, No. 12, pp. 353–360.) 'Ferrites' of the type $\mathrm{MFe_2O_4}$, in which M is a bivalent metal, have specific resistance 10^7–10^{12} times that of iron, so that eddy currents are negligible; hysteresis can be made small, while initial permeability is of the order of 1 000.

538.3 : 539.215.2 **3156**

The Electrical Constants of a Material Loaded with Spherical Particles.—L. Lewin. (*J. Instn elect. Engrs,* Part I, April 1947, Vol. 94, No. 76, p. 186.) Summary of 2139 of July.

538.63 : 546.289 **3157**

Hall Effect and Magneto-Resistance in Germanium.—W. C. Dunlap, Jr. (*Phys. Rev.,* 1st April 1947, Vol. 71, No. 7, p. 471.) Summary of Amer. Phys. Soc. paper on the results of measurements made with polycrystalline and single-crystal specimens. " The magneto-resistance effect in germanium appears to be at least an order of magnitude larger than is expected from the free electron theory for semiconductors."

546.431.284 : 621.385.1.032.216 **3158**

A Study of the Barium Silicate Interface of Oxide Coated Cathodes.—A. Eisenstein. (*Phys. Rev.,* 1st April 1947, Vol. 71, No. 7, p. 473.) Summary of Amer. Phys. Soc. paper. " The interface compound which is formed in the case of a BaO or (BaSr)O coating on a Si-Ni base is believed to be Ba_2SiO_4 rather than $BaSiO_3$ . . ." The relation of the compound to an anomalous voltage at the interface region (thickness from 5×10^{-4} to 10^{-3} cm) has been examined.

620.19 " 19/20 " **3159**

Corrosion Processes.—U. R. Evans. (*Metal Ind., Lond.,* 9th & 16th May 1947, Vol. 70, Nos. 19 & 20, pp. 335–337 & 355–357.) A survey, covering the last hundred years, of the British contribution to the understanding of metallic corrosion. A bibliography of 78 items is included.

621.315.615.2 **3160**

The Influence of the Concentration and Mobility of Ions on Dielectric Loss of Insulating Oils.—B. P. Kang. (*Trans. Amer. Inst. elect. Engrs,* December Supplement 1946, Vol. 65, p. 1132.) Discussion on 443 of February.

621.315.616.018.14 **3161**

A Note on the Effect of Combined Carbon Monoxide on the Power Factor of Polythene.—W. Jackson & J. S. A. Forsyth. (*J. Instn elect. Engrs,* Part I, April 1947, Vol. 94, No. 76, p. 187.) Summary of 2145 of July.

621.318.322 : [621.314.2.029.4/.5 **3162**

Use of Thin Permalloy Tape in H.F. Transformers.—(*Tech. mod.,* 1st/15th Feb. 1947, Vol. 39, Nos. 3/4, pp. 68–69. In French.) Summary of 2225 of 1946 (Ganz).

621.318.323.2.042.15 **3163**

Permeability of Dust Cores.—E. R. Friedlaender. (*Wireless Engr,* June 1947, Vol. 24, No. 285, pp. 187–188.) The observed increase of permeability may be explained by the assumption of irregular shaped particles and uneven distribution of air pockets. See also 1692 & 1693 of June.

621.396.69 **3164**

Materials and Techniques for Printed Electrical Circuits.—K. Rose. (*Materials & Methods,* March 1947, Vol. 25, No. 3, pp. 73–76.) A war-time development having many post-war applications whereby electrical components and circuit connections are produced as metallic and carbonaceous deposits on a ceramic plate thus enabling overall size of an instrument to be reduced while its mechanical stability is increased. See also 1913 of June (Sargrove) and 1887 of 1946 (Brunetti & Khouri).

669.14-41 : 538.221 : 621.314.1/.2 **3165**

Magnetic Sheet Steel.—D. Edmundson. (*J. Instn elect. Engrs,* Part I, April 1947, Vol. 94, No. 76, pp. 180–182.) An account of recent American improvements in both quality and production technique, special attention being given to heat treatment, cold rolling and subsequent re-annealing.

669.228 : 621.396.69 **3166**

New Types of Silver Coatings.—P. P. Hopf. (*Electronic Engng,* June 1947, Vol. 19, No. 232, pp. 193–194, 198.) A colloid containing up to 70% of metallic silver and containing no organic matter may be used in an offset printing press for depositing circuits such as spiral aerials and can facilitate the manufacture of silvered polythene capacitors by h.f. eddy current heating methods.

678.1 : 537.226 **3167**

Dielectric Properties of Rubber — particularly of Loaded Stock.—L. V. Holroyd, B. A. Mrowca & E. Guth. (*Phys. Rev.,* 1st April 1947, Vol. 71, No. 7, p. 488.) Summary of Amer. Phys. Soc. paper.

678.1 : 621.3.011.2 **3168**

The Electrical Resistivity of Conducting Rubber.—P. E. Wack. (*Phys. Rev.,* 1st April 1947, Vol. 71, No. 7, p. 489.) Summary of Amer. Phys. Soc. paper.

679.5 **3169**

Fugitive Fluorine works for Industry.—H. C. E. Johnson. (*Sci. Amer.,* Feb. 1947, Vol. 176, No. 2, pp. 60–62.) Short descriptions of commercial methods for the production of fluorine and some of its compounds. These include a new plastic called ' Teflon ' which is a polymer of tetrafluorethylene, is stable and tough from –75° to 250°C, is not attacked by any chemical except molten alkali metals and has excellent electrical properties. See also 1121 of April.

679.5 : 537.226 **3170**

Some Dielectric Properties of Butadiene-Containing Polymers and Copolymers.—R. F. Boyer, E. B. Baker & P. C. Woodland. (*Phys. Rev.,* 1st April 1947, Vol. 71, No. 7, p. 488.) Summary of Amer. Phys. Soc. paper.

MATHEMATICS

517.54 : 621.385.1 **3171**

Conformal Transformations in Orthogonal Reference Systems.—C. S. Roys. (*Proc. nat. Electronics Conference, Chicago,* Vol. 2, pp. 323–328.) General equations are derived for transformations which correspond to the Cauchy-Riemann equations for Cartesian coordinates ; these are applied to shielding and valve problems involving recurrent structures.

518.5 **3172**

The Mechanical-Transients Analyzer.—G. D. McCann. (*Proc. nat. Electronics Conference, Chicago,* Vol. 2, pp. 372–392.) An electric analogue computer for the solution of complex algebraic and differential equations. It is designed primarily for the analysis of mechanical vibration problems and servomechanisms.

519.28 : 621.3 **3173**
A New Approach to Probability Problems in Electrical Engineering.—H. A. Adler & K. W. Miller. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1118–1119.) Discussion on 465 of February.

517.512.4 (083.5) **3174**
Tables of Spherical Bessel Functions, Vol. 1. [Book Review]—Mathematical Tables Project, National Bureau of Standards. Columbia University Press, New York, 1947, 378 pp., $7.50. (*Gen. elect. Rev.*, May 1947, Vol. 50, No. 5, p. 60.) The Introduction summarizes their properties, expresses the Fresnel integrals in terms of them and describes methods of computation. The present tables, with their great scope and accuracy, now make possible the solution of a large number of important problems in a wide variety of fields.

MEASUREMENTS AND TEST GEAR

620.16 : 621.319.4.011.5 **3175**
Metallized Capacitor Tests.—P. Godley & J. C. Balsbaugh. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 112–115.)

620.163 : 621.385 **3176**
Electrical Production Tests for High-Power Tubes.—Sheren. (*See* 3334.)

620.163 : 621.385 **3177**
Production Test Facilities for High-Power Tubes.—Lyndon. (*See* 3335.)

621.317.32 : 621.317.755 **3178**
Measurement of H.T. by Cathode-Ray Tube.—E.M.I. Laboratories. (*Electronic Engng*, June 1947, Vol. 19, No. 232, p. 177.) A special tube is used with two anode systems. The unknown voltage is applied to the second of these and a calibrated lower voltage to the first. The value of this lower voltage for accurate focusing of the beam is a measure of the unknown voltage.

621.317.333 + 621.317.37] : 621.315.212.029.6 **3179**
The Voltage Characteristics of Polythene Cables.—R. Davis, A. E. W. Austen & W. Jackson. (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, pp. 154–165. Discussion, pp. 165–170.) An experimental investigation of breakdown voltage, power factor, life with pulse voltages, discharge characteristics at power frequencies and performance with 600-Mc/s r.f. pulse operation. Tentative voltage ratings based on this work are proposed.

621.317.333.027.3 **3180**
High Voltage D.C. Testing of Rubber-Insulated Wire.—W. N. Eddy & W. D. Fenn. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, p. 1126.) Discussion on 3668 of 1946.

621.317.34 **3181**
Highly-Selective Transmission-Measuring Equipment for Communication Circuits.—D. G. Tucker. (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, pp. 211–216.) The equipment can be designed to be within a specified degree of accuracy; ± 0.25 db is readily obtainable. Basic principles are: (*a*) direct demodulation of the test signal by means of an identical frequency obtained from an oscillator synchronized to the test tone, (*b*) discrimination against unwanted line signals obtained by means of low-pass filters, (*c*) the elimination of the effect of the phase difference between the test and demodulating tones by Barber's two-path method (2697 of September), and (*d*) the use of an envelope-modulated test signal.

621.317.41.029.62 : 538.221 **3182**
Ferromagnetism at Very High Frequencies: Part 1 — Magnetic Iron at 200 Mc/s.—M. H. Johnson, G. T. Rado & M. Maloof. (*Phys. Rev.*, 1st March 1947, Vol. 71, No. 5, pp. 322–323.) A method of determining the complex permeability by measuring the phase velocity and attenuation in a coaxial line whose centre conductor is the metal under investigation. The results at 200 Mc/s suggest that magnetization by displacement of domain boundary walls is greatly reduced and magnetization by rotation is the dominant effect.

621.317.41.029.62 : 538.221 **3183**
Complex Permeability of Magnetic Iron at 200 Mc/s as a Function of Polarizing Field.—G. T. Rado, M. H. Johnson & M. Maloof. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, p. 472.) Summary of Amer. Phys. Soc. paper. Results obtained by extension of method of 2852 of September.

621.317.44.025 **3184**
Alternating Current Probe for the Measurement of Magnetic Fields.—E. C. Gregg. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, p. 482.) Summary of Amer. Phys. Soc. paper. The probe consisted of a 150-turn primary winding and a 100-turn secondary wound on a 0.1-inch length of Permalloy wire 0.01 inch in diameter. The probe had the dimensions of a cylinder 0.1 inch long and 0.08 inch in diameter. An a.c. null detector method was used, an adjustable d.c. current in the primary serving as a measure of the unknown magnetic field. The accuracy of the probe measurements was about 0.2%.

621.317.7 + 621.38 + 621.396.69 **3185**
The Physical Society's Exhibition.—(*Electronic Engng*, June 1947, Vol. 19, No. 232, pp. 195–198.) See also 2494 of August.

621.317.7 + 621.396.69 **3186**
The R.C.M.F. [Radio Component Manufacturers' Federation] **Exhibition.**—(*See* 3078.)

621.317.7.029.64 : 621.396.611.4 **3187**
Cavity Resonators for Measurements with Centimetre Electromagnetic Waves.—B. Bleaney, J. H. N. Loubser & R. P. Penrose. (*Proc. phys. Soc.*, 1st March 1947, Vol. 59, No. 332, pp. 185–199.) "A wave-meter for wavelengths of about a centimetre, with an accuracy of 1 to 2 parts in 10 000, is described." Measurements at wavelengths of 3.2 and 1.35 cm of the dielectric constant and power factor of six non-polar liquids are described and tabulated.

621.317.72.029.56/.58] : 621.392.43 **3188**
Additional Notes on the "Micromatch".—M. C. Jones & C. Sontheimer. (*QST*, July 1947, Vol. 31, No. 7, p. 45.) A complete account of the modifications to the original design (2853 of September) to

improve the performance at 30 Mc/s; details of the revised circuit and components and the best method of assembly are given.

621.317.73.029.63 : 621.315.212 **3189**

Comparator for Coaxial Line Adjustments.—Woodward. (*See* 3016.)

621.317.733 **3190**

Measuring Megohms to a Few Parts in a Million.—H. T. Wilhelm. (*Bell Lab. Rec.*, April 1947, Vol. 25, No. 4, pp. 155–158.) Bridge method of measurement used in production to obtain resistance-ratios constant to <100 parts in 10^6 for a range of temperature from –40° to 60°C.

621.317.755 **3191**

Trends in Cathode-Ray Oscillograph Design.—W. L. Gaines. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 454.) Summary only.

621.317.755 : 621.394.813 **3192**

A Cathode-Ray Telegraph Distortion Measuring Set.—W. T. Rea. (*Bell Lab. Rec.*, April 1947, Vol. 25, No. 4, pp. 150–154.) A portable set with a built-in supply unit. A simplified circuit diagram is given.

621.317.761 : 621.165 **3193**

An Electronic Frequency Meter and Speed Regulator.—E. Levin. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1181–1182.) Discussion on 1148 of April.

621.317.761.029.64 **3194**

S.H.F. Heterodyne Frequency Meter.—C. D. Jeffries. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 134–137.) Portable instrument for the range 450–10 000 Mc/s with a maximum error less than 0.05%.

621.317.784 : 621.3.015.33 **3195**

The Notch Wattmeter for Low-Level Power Measurement of Microwave Pulses.—D. F. Bowman. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 361–371.) The r.f. pulse of unknown amplitude is matched in amplitude with an interrupted c.w. signal. The interrupted portion or notch of the c.w. signal is adjusted to equal in length and to coincide in time with the unknown pulse. The amplitude is then measured by a self-balancing thermistor bridge, an instrument which indicates average power and measures accurately the peak pulse power of the unknown signal. Powers from 20–200 μW can be measured within 5%; accuracy is independent of pulse shape, pulse length, repetition rate, and frequency modulation during the pulse.

621.317.79 : 621.315.212 **3196**

A Standing-Wave Meter for Coaxial Lines.—H. O. Pattison, Jr, R. M. Morris & J. W. Smith. (*QST*, July 1947, Vol. 31, No. 7, pp. 41–43.) A full account of the construction and performance, with diagrams and details of circuit and components. The meter is essentially a resistance bridge with R_1 equal to the impedance of the line under test, in this case 52 Ω, so that substitution of R_1 is necessary for other cables. A calibration curve is given for the instrument shown, and the method of calibration is described fully.

621.317.79 : 621.392 **3197**

The Theory and Design of Several Types of Wave Selectors.—Korman. (*See* 3019.)

621.317.79 : 621.396.611 **3198**

The Design of a Universal Automatic Circuit Tester and Its Application to Mass-Production Testing.—R. C. G. Williams, J. E. Marshall, H. G. T. Bissmire & J. W. Crawley. (*J. Instn elect. Engrs*, Part I, April 1947, Vol. 94, No. 76, pp. 194–196.) Summary of 2181 of July.

621.317.79 : 621.396.615 **3199**

The Sweep-Frequency Signal Generator.—R. Endall. (*Radio News*, June 1947, Vol. 37, No. 6, pp. 47–50..114.) A full general description of instruments used for testing i.f. and r.f. circuits and video amplifiers. The frequency response curve is observed visually on an oscilloscope screen.

621.317.79 : 621.396.615.14 **3200**

A New Frequency-Modulated Signal Generator.—D. M. Hill. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 50–51.) Summary of a Rochester Fall Meeting paper. Covers the range 54–216 Mc/s and can be used for amplitude or frequency modulation either separately or simultaneously. A circuit diagram is given.

621.317.79.029.62 **3201**

Standing-Wave Ratio Meter for V.H.F.—G. Glinski. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 34–35.) A simple directional coupler, consisting essentially of a section of auxiliary transmission line with matched terminations, coupled to the main transmission line. It can also be used as a power meter.

621.317.79.089.6 : [621.396.615.12/.14 **3202**

A Method of Calibrating Standard-Signal Generators and Radio-Frequency Attenuators.—G. F. Gainsborough. (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, pp. 203–210.) The relative magnitudes of r.f. signals are measured by passing the signals through a linear heterodyne frequency-converter and comparing the magnitudes of the resultant i.f. signals with those of signals from a standard i.f. generator of known performance. Signal ratios up to 10 db can be measured to 0.02 db; greater ratios up to 90 db can be measured to within 0.2% of their decibel values. Signals 16 db below noise can be measured to 0.5 db. The method has been used for frequencies between 3 and 3 000 Mc/s and this range can be extended.

621.396.11 + 538.566 **3203**

Velocity of Electromagnetic Waves.—Essen. (*See* 3249.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

533.5 : 539.163.2.08 : 620.191.33 **3204**

The Mass Spectrometer as an Industrial Tool.—A. O. Nier. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 190–197.) Applications to continuous process gas analysis and to leak detection in high-vacuum systems.

535.33.072.029.63 **3205**

A Microwave Spectrograph.—R. H. Hughes & E. B. Wilson, Jr. (*Phys. Rev.*, 15th April 1947, Vol. 71, No. 8, pp. 562–563.) The basic principle is the use of a r.f. Stark effect field which modulates the absorption by the gas so that a radio receiver can be used for detection purposes.

538.74 : 621.385.832 **3206**

Cathode-Ray Compass.—R. T. Squier. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 121–123.) Uses a vertical electron beam in a gimbal-mounted tube with four horizontal quadrantal targets. The action depends on the varying target currents due to the deflection of the beam by the earth's magnetic field.

539.16.08 **3207**

Velocity of Propagation of the Discharge in Geiger-Müller Counters.—E. Wantuch. (*Phys. Rev.*, 1st May 1947, Vol. 71, No. 9, p. 646.) Experimental results support the theory that the positive-ion sheath spreads by photon emission and ionization. Values of the propagation velocity are lower than those found by Huber, Alder & Baldinger (2867 of September).

539.17 : 620.93 **3208**

Some Fundamental Problems of Nuclear Power-Plant Engineering.—E. T. P. Neubauer. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 673–679.)

621.313.2-9 : 621.314.653 **3209**

Large Electronic Direct-Current Motor Drives.—M. M. Morack. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 212–225.) The use of sealed ignitrons extends electronic drives up to about 600 h.p. where reversing is not required.

621.313.2-9 : 621.316.721.076.7 **3210**

Constant-Current Systems for Electronic Control of D.C. Motors.—O. W. Livingston. (*Gen. elect. Rev.*, May 1947, Vol. 50, No. 5, pp. 38–44.) Adjustment of speed for a wide variety of applications is effectively accomplished through suitable modification of the basic constant-torque system.

621.313.2-9 : 621.316.721.076.7 **3211**

Electronic Constant-Current Motor Systems.—O. W. Livingston. (*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 432–437.) Constant torque characteristics simplify use for certain applications. As adjustable speed drive, similar characteristics to variable voltage systems, with minimum number of power valves.

621.316.7 : 621.313.2-9 **3212**

Basic Procedures in Motor Control : Part 1 — D.C. Series Motors.—G. W. Heumann. (*Gen. elect. Rev.*, May 1947, Vol. 50, No. 5, pp. 23–34.) Methods of calculating performance and of selecting types of control for matching motor characteristics to the operating requirements. To be continued.

621.316.718.5.076.7 : 621.313.3-9 **3213**

Electronic Speed Control of A.C. Motors.—W. H. Elliot. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 226–238.) A review of basic circuits, with practical applications.

621.317.39 : [531.71 + 531.787 **3214**

The Pressuregraph.—A. Crossley. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 352–360.) A compact pickup is used to modulate a h.f. source and transform pressure variation or mechanical motion into a pressure-time or displacement-time graph on a c.r.o.

621.317.39 : 531.717.1 **3215**

The Z-Callipers.—A. G. Long. (*Electronic Engng*, June 1947, Vol. 19, No. 232, p. 187.) Details of a simple instrument for measuring bulb wall thickness in terms of readings of an a.c. milliammeter

621.317.39 : 6 **3216**

Electric Gauges in Quality Control.—J. Manuele. (*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 441–444.)

621.317.39 : 620.178.3 **3217**

A Modern Vibration Measurement Laboratory : Part 3 — Types of Apparatus.—A. J. Cogman. (*Electronic Engng*, May 1947, Vol. 19, No. 231, pp. 152–156.) D.c. bridge methods of stress measurement using temperature compensation. An a.c. bridge circuit for measuring steady stress by means of a c.r.o. is illustrated. A mobile recording unit includes an amplifier of almost uniform response from 2 c/s to 10 kc/s. Some preliminary notes are also given on the measurement of h.f. vibrations. For part 4 see 3218 below.

621.317.39 : 620.178.3 **3218**

A Modern Vibration Measurement Laboratory : Part 4 — Fatigue Testing.—D. M. Corke. (*Electronic Engng*, June 1947, Vol. 19, No. 232, pp. 189–192.) The test apparatus is arranged as part of a regenerative electromechanical system ; instability is reduced by limiting the amplitude and adjusting the phase of the electrical feedback. For part 3 see 3217 above.

621.317.755 : 535.33 **3219**

The Cathode-Ray Spectrograph.—R. Feldt & C. Berkley. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 198–211.) Produces complete spectral distribution curves on a c.r. screen. Applications to colour matching, etc., are suggested.

621.317.755 : 771.36 **3220**

Cathode-Ray Tube Shutter-Testing Instrument.—D. T. R. Dighton & H. McG. Ross. (*J. sci. Instrum.*, May 1947, Vol. 24, No. 5, pp. 128–133.) The apparatus gives, on an after-glow c.r. tube, the characteristic curve of a camera shutter, i.e., the variation with time of the light passing through the shutter. Full details are provided of the various circuits used in the instrument.

621.365.5 + 621.365.92] : 621.316.726.078.3 **3221**

The Problem of Constant Frequency in Industrial High Frequency Heating Generators.—E. Mittelmann. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 503–510.)

621.365.5 : 621.314.653 **3222**

Ignitron Converters for Induction Heating.—R. J. Ballard & J. L. Boyer. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 455–469.) A ' cyclo-inverter ' circuit converting directly 3-phase 60-cycle power to single-phase power at a higher frequency.

621.365.52 **3223**

Coreless Induction Furnaces.—M. J. Marchbanks. (*J. Instn elect. Engrs*, Part I, Feb. 1947, Vol. 94, No. 74, pp. 119–120.) Summary of I.E.E. paper. Another account noted in 1937 of 1946.

621.365.92 **3224**
Heating by Dielectric Losses.—G. Gourod. (*Tech. mod.*, 1st/15th Feb. & 1st/15th April 1947, Vol. 39, Nos. 3/4 & 7/8, pp. 45–49 & 113–119. In French.) Formulae and graphical methods are given for finding the h.f. power required to raise a given quantity of a dielectric to a given temperature. Applications to many branches of industry are reviewed.

621.365.92 : 679.5 **3225**
Dielectric Preheating in the Plastics Industry.—G. F. Leland, D. E. Watts & T. N. Willcox. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 488–502.)

621.365.92.029.64 **3226**
Microwaves and Their Possible Use in High Frequency Heating.—T. P. Kinn & J. Marcum. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 470–487.) Sources of c.w. power for r.f. heating at frequencies from 1 500 to 30 000 Mc/s are discussed and microwave coaxial transmission line and waveguide technique, including matching methods, described. Possible methods of using waveguides, aerials and resonators to apply r.f. power to dielectric materials of various shapes are suggested.

621.38 : 621.9 **3227**
The Electronic Method of Contouring Control.—J. Morgan. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 239–249.) See also 207 of January.

621.38 : 655.324.5 **3228**
Electronic Register Control for Multicolor Printing.—W. D. Cockrell. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1117–1118.) Discussion on 3697 of 1946.

621.383.001.8 **3229**
An Electronic Reading Aid for the Blind.—V. K. Zworykin & L. E. Flory. (*Proc. Amer. phil. Soc.*, 5th April 1947, Vol. 91, No. 2, pp. 139–142.) A description of the equipment and a critical account of its application. It is not considered that the apparatus is ready for general use, although after about 60 hours training two blind readers were able to identify letters at random with about 80% accuracy. See also 3700 of 1946.

621.383.5.001.8 + [621.383.5 : 621.318.57 **3230**
The A.C. Behaviour of the Barrier Layer Photo Cell.—Sargrove. (*See* 3332.)

621.384.3 **3231**
Military Application of Infrared Viewers.—G. E. Brown. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 181–188.)

621.384.6 **3232**
Optimum Disturbing Field for Synchrotron Beam Ejection.—F. K. Goward & J. Dain. (*Nature, Lond.*, 10th May 1947, Vol. 159, No. 4045, pp. 636–637.) Theoretical analysis of the reactive power required to build up the disturbing field and of the conditions that minimize this power.

621.384.6 **3233**
Nuclear Research with the 100-MeV Betatron.—E. E. Charlton & G. C. Baldwin. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 650–672.) A description of the General Electric betatron, with experimental results.

621.384.6 **3234**
Initial Performance of the 184-Inch Cyclotron of the University of California.—W. M. Brobeck, E. O. Lawrence, K. R. MacKenzie, E. M. McMillan, R. Serber, D. C. Sewell, K. M. Simpson & R. L. Thornton. (*Phys. Rev.*, 1st April 1947, Vol. 71, No. 7, pp. 449–450.) A brief description of equipment and experiments by which deuteron and alpha-particle beams, of approximately 200 and 400 MeV respectively, have been produced. The characteristics of the high power (18 kW input) frequency-modulated h.f. generator are mentioned.

621.384.6 **3235**
An Accelerator Column for Two to Six Million Volts.—R. R. Machlett. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 680–687.) Manufacturing techniques for multi-section tubes.

621.385.833 **3236**
Summarized Proceedings of Conference on the Electron Microscope Oxford 1946.—(*J. sci. Instrum.*, May 1947, Vol. 24, No. 5, pp. 113–119.) Sessions were devoted to: (*a*) construction, including descriptions of various recent developments and discussion of design principles, (*b*) the technique of specimen preparation, and (*c*) special applications.

621.385.833 **3237**
Proceedings of the Electron Microscope Society of America.—(*J. appl. Phys.*, March 1947, Vol. 18, No. 3, pp. 269–273.) Titles and abstracts of 36 papers presented at the 1946 annual meeting.

621.385.833 **3238**
On the Limit of Resolution of the Electron Microscope: Round Lens.—H. Bruck. (*C. R. Acad. Sci., Paris*, 2nd June 1947, Vol. 224, No. 22, pp. 1553–1555.) A discussion of the different values obtained for the limit of resolution in the Gauss plane by use of the superposition formula, that of Born & Glaser and Rayleigh's $\lambda/4$ rule, with graphs and a numerical table.

621.385.833 **3239**
A Methyl Methacrylate-Silica Replica Technique for Electron Microscopy.—A. F. Brown & W. M. Jones. (*Nature, Lond.*, 10th May 1947, Vol. 159, No. 4045, pp. 635–636.) A method requiring neither pressure nor high temperature and applicable to many types of material.

621.386.001.8 **3240**
One-Millionth-Second Radiography and Its Applications.—C. M. Slack & D. C. Dickson, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 600–606.) Outline of the development of the modern cold-cathode X-ray tube, in which 1 000-A microsecond pulses are obtained, and of the associated 300-kV surge-generator. The equipment has had particular application to studying the effect of bullets passing through material opaque to light. Summary noted in 1613 of 1946.

621.391.64 **3241**
Modulation of Infrared Sources for Signaling Purposes.—W. S. Huxford. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 158–170.) An account of various modulation methods, including mechanical modulation used by the Japanese, and German mechanical and optical methods. Details are given of two new types of electrically modulated arc lamps, (*a*) the concentrated arc, and (*b*) the caesium vapour arc.

621.396.9.083.7 : 551.5 **3242**

Telemetering from V-2 Rockets : Part 2.—V. L. Heeren, C. H. Hoeppner, J. R. Kauke, S. W. Lichtman & P. R. Shifflett. (*Electronics*, April 1947, Vol. 20, No. 4, pp. 124–127.) A time-modulated pulse system is used. The output of the ground station 1 000-Mc/s receiver contains trains of pulses spaced according to instrument readings in the rocket. Circuits for decoding these pulses into individual voltages for recording are given. For part 1 see 2536 of August.

621.398 : 621.397.6 **3243**

Television Equipment for Guided Missiles.—C. J. Marshall & L. Katz. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 115–129.)

623.26 : 621.396.9 **3244**

Detectors for Buried Metallic Bodies.—L. F. Curtis. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 339–351.) Various development problems are discussed and a description is given of the SCR-625 detector, which uses a 1-kc/s transmitter and receiver and a balanced coil system.

623.978 + 550.838] : 538.71 **3245**

Magnetic Prospecting.—W. J. Shackelton. (*Bell Lab. Rec.*, April 1947, Vol. 25, No. 4, pp. 142–145.) Short account of an airborne magnetic detector, and its application to submarine detection and geophysical prospecting.

778.332 **3246**

Electronic Timing provides Uniform X-Ray Exposures.—H. D. Moreland. (*Radiography*, May 1947, Vol. 13, No. 149, pp. 51–54.) X-ray radiation, after passing through an object, is converted to visible radiation measured by a photoelectric cell which opens a relay switch in the X-ray circuit.

PROPAGATION OF WAVES

538.566.2 : 517.94 **3247**

Two Notes on Phase-Integral Methods.—Furry. (*See* 3095.)

538.569.4.029.64 **3248**

Various Papers on Absorption of Microwaves.—(*See* 3096 to 3100.)

621.396.11 + 538.566 **3249**

Velocity of Electromagnetic Waves.—L. Essen. (*Nature, Lond.*, 3rd May 1947, Vol. 159, No. 4044, pp. 611–612.) An account of the results obtained from velocity determination by resonance of a short length of a waveguide closed at both ends, using centimetre waves. The accuracy is comparable with that of light velocity measurements, and the average result obtained is 17 km/s higher than that generally accepted for light waves, although this discrepancy is within the combined limits of error for the two measurements.

621.396.11 **3250**

The Elements of Wave Propagation using the Impedance Concept.—H. G. Booker. (*J. Instn elect. Engrs*, Part III, May 1947, Vol. 94, No. 29, pp. 171–198. Discussion, pp. 199–202.) The theory of transmission lines is normally approached from the point of view of circuits and developed in terms of the impedance concept, whereas the theory of more general forms of wave propagation tends to be developed from Maxwell's equations. By using the concept of field impedance, propagation and transmission line phenomena can be integrated into a single picture. Phenomena such as the Brewster angle, the critical angle, propagation in hollow metal pipes, reflection and transmission by wire netting, etc., all have their counterparts in transmission line theory. For example, it is easier to explain the part played by the less dense medium in total internal reflection by regarding total internal reflection as analogous to a reactive load on the end of a simple transmission system. The impedance concept can in fact be regarded as complementary to the optical approach to electromagnetic phenomena.

The impedance concept is here applied to: (*a*) a simple infinite plane wave, (*b*) reflection at a discontinuity between two dielectrics, (*c*) extension of (*b*) to conducting media and to oblique incidence, (*d*) extension of the use of circle diagrams, (*e*) the effect of obstacles such as an infinite plane sheet of wire netting on an incident plane wave, (*f*) propagation along a waveguide. Energy, metal losses, the use of matrices and radiation from aerials are also discussed.

The correspondence between transmission-line and propagation phenomena is made clear by placing corresponding equations in parallel columns ; for example, the obstacles mentioned in (*e*) above correspond to lumped shunt impedances.

621.396.11 : 550.385 **3251**

Effect of Magnetic Perturbations on the Velocity of Short Radio Waves.—N. Stoyko. (*C. R. Acad. Sci., Paris*, 5th May 1947, Vol. 224, No. 18, p. 1281.) From reception results for λ 17–35 m at Buenos Ayres, Paris, Tokyo and Washington and magnetic data provided by the University of Paris, it is found that for direct propagation the apparent velocity diminishes from 275 660 km/sec for magnetically calm conditions to 272 090 km/sec for very disturbed conditions, while for 'super-propagation' (along the longer arc of the great circle) the apparent velocity increases from 284 502 km/sec for calm days to 288 283 km/sec for very disturbed conditions. For earlier work see 3780 of 1945, 945 of 1942 and back references.

621.396.11 : 551.510.535 **3252**

Equivalent Path and Absorption in an Ionospheric Region.—J. C. Jaeger. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 87–96.) Formulae for the calculation of absorption and equivalent path for rays vertically incident on an ionized region, the ionization of which varies exponentially (a Chapman region), are deduced for the cases of transmission and of reflection from above and below. Tables of numerical values are appended.

The results are compared with those obtained on the basis of a parabolic variation of ionization.

621.396.11 : 551.510.535 **3253**

Predicting World Area Coverage by Reflected Waves.—N. A. Atwood. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 38–42 . . 104.) Technical details of a new method for predicting the maximum usable frequency and the optimum working frequency for any radio link. Use is made of a slide-rule type of device consisting of a transparent world map, a transparent time-frequency chart and a series of great-circle charts. These are similar to the maps and charts contained in the C.R.P.L. Basic Radio Propagation Predictions.

621.396.11.029.58 : 551.510.535 **3254**

Doppler Effect in Propagation.—H. V. Griffiths. (*Wireless Engr*, June 1947, Vol. 24, No. 285, pp. 162–166.) Changes of 2–7 parts in 10^8 have been observed in the received frequency of WWV standard transmissions on 15 Mc/s, which are accurate to ± 2 parts in 10^8. Further measurements under different conditions have shown that the divergence is not wholly or largely due to the difference in frequency standards.

Trigonometrical formulae for the path length and the Doppler effect resulting from the changes in path length are deduced.

A rate of change of the virtual height of the reflecting layer of the order of 3–6 m/s could account for the observed frequency difference between the received and transmitted signals.

621.396.11.029.6 **3255**

Radio Propagation at Frequencies above 30 Megacycles.—K. Bullington. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 130.) Summary only. Discusses the effect on propagation of frequency, range, aerial height, curvature of the earth, atmospheric conditions, etc. Charts are given from which an estimate of received power and field intensity for a given transmission path can be obtained quickly.

621.396.11.029.6 : 621.397.81 **3256**

Analyzing TV Propagation at U.H.F.—R. P. Wakeman. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 62–65 . . 115.) From investigations by the F.C.C. of diffraction effects, u.h.f. at present carrier power levels appears to be useful only for line-of-sight service.

621.396.11.029.64 : 535.434 **3257**

Radar Echoes from the Sea Surface at Centimetre Wave-Lengths.—H. Davies & G. G. Macfarlane. (*Proc. phys. Soc.*, 1st Nov. 1946, Vol. 58, No. 330, pp. 717–729.) An account is given of quantitative measurements of the echoes obtained from the sea surface under various weather conditions with radars operating on wavelengths of 1.25, 3 and 10 cm. The necessary theoretical treatment is given; a 'scattering coefficient' of the surface is defined and its variation with sea conditions and angle of elevation is shown. See also 423 of February and 2218 of July, for which the above U.D.C. would have been preferable.

621.396.81.029.63 : 621.397.81 **3258**

Results of Field Tests on U.H.F. (490 Mc/s) Color Television Transmissions in the New York Metropolitan Area.—W. B. Lodge. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 156.) Summary only.

RECEPTION

621.396.621 + 621.396.662.2.029.62 **3259**

Front-End Design of F.M. Receivers.—C. R. Miner. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 564–569.) Details of a new type of guillotine tuner for receivers for the 100-Mc/s band. See also 2052 of July.

621.396.621 **3260**

High Fidelity Miniature Tube Receiver.—J. C. Hoadley. (*Radio News*, April 1947, Vol. 37, No. 4, pp. 47–49 . . 171.)

621.396.621 : 621.396.681 **3261**

28 Volts H.T. and L.T.?—R. Terlecki & J. W. Whitehead. (*Electronic Engng*, May 1947, Vol. 19, No. 231, pp. 157–159.) Discusses the design of receivers for operation direct from a 28-V supply, without either rotary converters or vibrators. Tests with a modified American communications receiver gave very satisfactory results. Suitable valves are listed.

621.396.621.54 : 621.396.615.142 : 621.396.96 **3262**

Reflex Oscillators for Radar Systems.—McNally & Shepherd. (*See* 3057.)

621.396.621.54.029.6 : 621.396.5 **3263**

An Experimental Receiver for Ultra-Short-Wave Radio-Telephony with Frequency Modulation.—A. van Weel. (*Philips tech. Rev.*, July 1946, Vol. 8, No. 7, pp. 193–198.) Description of a superheterodyne receiver for a mean carrier frequency of about 300 Mc/s. The push-pull mixing stage is made self-oscillating by introducing an 'asymmetric' input circuit tuned to the local oscillator frequency. As no separate oscillator is required there is a reduction in fluctuation noise, so that a h.f. amplifier can be omitted with only a small reduction in the signal/noise ratio. For a description of the transmitter used for the same Tilburg-Eindhoven link, see 2606 of August.

621.396.622 **3264**

A New Detector for Frequency Modulation.—W. E. Bradley. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 570–576.) A description of the circuit, design procedure, and alignment of a single stage f.m. detector. Tests show it to be comparatively unresponsive to a.m. and free from practical defects.

621.396.662 : 621.396.621.54.029.62 **3265**

V.H.F. Tuner Design.—G. Wallin & C. W. Dymond. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 557–563.) The design of a single-oscillator double-superheterodyne circuit for use on the 88–108 Mc/s f.m. band is described. Receiver performance characteristics are given.

621.396.82 : 621.396.619.13 **3266**

Frequency Modulation Distortion caused by Common- and Adjacent-Channel Interference.—M. S. Corrington. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 522–560.) Formulae are developed for computing the amplitudes of harmonics and cross-modulation formed by the interference of two f.m. waves. From these the effects on f.m. reception of a de-emphasis network following the discriminator, of a low-pass audio filter and of nonlinear phase shift in the amplifiers are calculated.

621.396.82.029.5 **3267**

Interference between V.H.F. Radio Communication Circuits.—W. R. Young, Jr. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 131.) Summary only. A discussion of common causes of such interference, with measurement results and computation formulae.

621.396.822 : 621.396.615.141.2 **3268**

Excess Noise in Cavity Magnetrons.—R. L. Sproull. (*J. appl. Phys.*, March 1947, Vol. 18, No. 3, pp. 314–320.) A fluctuating noise modulation in excess of shot noise in 4 000-Mc/s magnetron oscillations is described. The effects of gas pressure and cathode material on the ratio of noise to r.f. output were investigated and the gas near the cathode examined by spectrograph. The excess noise is attributed to the liberation of metal atoms from the oxide coated cathode by bombarding electrons. Details are given of a cathode in which the oblique path of bombardment is used to separate the emitting and bombarded surfaces.

621.396.828 : 621.396.619.16 **3269**

Pulse Modulation Noise Suppression Characteristics.—S. Moskowitz & D. D. Grieg. (*Communications*, March 1947, Vol. 27, No. 3, pp. 42–43.) Summary of 1947 I.R.E. Convention paper.

STATIONS AND COMMUNICATION SYSTEMS

621.394.44 **3270**

Carrier Telegraphy.—J. te Winkel. (*Philips tech. Rev.*, July 1946, Vol. 8, No. 7, pp. 206–213.) A method in which 18 telegraphic channels are contained in the frequency band of a single telephone connection.

621.395.44 : 621.315.052.63 **3271**

Rural Carrier Telephony.—(*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 425–431.) A carrier system for application on power lines. Summary of "A Carrier Telephone System for Rural Service", by J. M. Barstow and "Application of Rural Carrier Telephone System", by E. H. B. Bartelink, L. E. Cook, F. A. Cowan & G. R. Messmer.

621.395.44 : 621.315.052.63 **3272**

Field Tests on Power-Line Carrier-Current Equipment.—R. H. Miller & E. S. Prud'homme. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1177–1178.) Discussion on 1207 of April.

621.395.5 : 621.317.34 **3273**

Transmission Rating of Telephone Systems.—W. A. Codd. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, p. 1123.) Discussion on 1208 of April.

621.396.1 **3274**

The Job Ahead.—C. R. Denny. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 598–599.) The chairman of the F.C.C. asks radio engineers for ways and means of winning the battle for ether space.

621.396.619.11/.13 : 534.78 **3275**

Narrow-Band F.M. for Voice Communication.—N. Bishop. (*QST*, May 1947, Vol. 31, No. 5, pp. 20–23.) Comparison of a.m. and narrow-band f.m. shows that the latter gives greater intelligibility with weak signals.

621.396.619.11/.13].029.62 : 621.396.931 **3276**

Amplitude-Modulated Communication in the V.H.F. Band.—D. H. Hughes. (*Electronic Engng*, May 1947, Vol. 19, No. 231, pp. 143–146, 151.) The relative merits of f.m. and a.m. are discussed and miniature mobile radiotelephone equipment using a.m. is described. It occupies 1 ft^3 for a weight of 40 lb and radiates 12 W at a frequency between 80 and 100 Mc/s. The results of some field tests are given.

621.396.619.16 : 621.396.13 : 621.396.97 **3277**

Pulse-Time Multiplex Broadcasting on the Ultra-High Frequencies.—D. D. Grieg & S. Moskowitz. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 531–547.) The advantages of a multiplex broadcast system over a simplex system are discussed. Details are given of time-division and frequency-division multiplex systems, apparatus employed, and results obtained. See also 3049 of 1946 (Grieg).

621.396.619.16 : 621.396.41 **3278**

Multiplex employing Pulse Time and Pulsed F.M. Modulation.—H. Goldberg & C. C. Bath. (*Communications*, March 1947, Vol. 27, No. 3, pp. 41–42.) Summary of 1947 I.R.E. Convention paper.

621.396.65+621.397.26] : 629.135 **3279**

Stratovision System of Communication.—C. E. Nobles. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 54–72.) The proposed system uses high-altitude aircraft transmission. The same aircraft may carry television and f.m. transmitters, as well as radio-relaying transmitters. Experimental curves are given of field strengths at various distances from an aircraft transmitting on 107.5 Mc/s and 514 Mc/s at about 20 000 ft. For previous accounts see 3970 of 1945, 3090 and 3801 of 1946 and 2588 of August.

621.396.65+621.397.26] : 629.135 **3280**

The Stratovision System of Communication — Aircraft Requirements.—W. K. Ebel. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 73–81.) Design considerations for reliability and economy of operation.

621.396.65.029.63 : 621.396.619.16 **3281**

Pulse Time Division Radio Relay.—B. Trevor, O. E. Dow & W. D. Houghton. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 561–575.) Description of a radio relay set developed for the U.S. Army. Two sets provide eight two-way telephone circuits over a line-of-sight path of between 50 and 100 miles. The frequency range is 1 350–1 500 Mc/s; a time division multiplex system and pulse position modulation are used. See also 3283 below.

621.396.65.029.64 **3282**

A Microwave Relay Communication System.—G. G. Gerlach. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 511–530.) A description of a multi channel f.m. 4 000-Mc/s relay system using a 1-Mc/s f.m. sub-carrier. The intermediate relay stations are unattended. See also 1578 of May (Thompson) and 3283 below.

621.396.65.029.64 **3283**

A Microwave Relay Communication System.—G. G. Gerlach. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 576–600.) A review of experimental results obtained with a 4 000 Mc/s multichannel relay system using a f.m. sub-carrier for frequency-modulation of the final carrier. Demodulation to sub-carrier frequency is effected at the relay stations. The equipment developed from these experiments and to be used commercially for linking New York, Washington and Pittsburg, is described in detail. See also 3048 and 3748 of 1946 and 2935 of September and 3282 above.

621.396.712.2 **3284**

WNEW Program Dispatching System.—J. Peterson. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 50–51 . . 111.) A master control console is designed for flexibility in handling multiple programmes and can deal with seven studios and three remote channels simultaneously.

621.396.931 **3285**

Vehicle Radiotelephony becomes a Bell System Practice.—A. C. Peterson, Jr. (*Bell Lab. Rec.*, April 1947, Vol. 25, No. 4, pp. 137–141.) A brief description of a mobile radiotelephone system, operating on frequencies in the range 100–200 Mc/s and providing two-way communication between any subscriber's vehicle and the normal telephone system.

621.396.931 **3286**

Selective-Calling Systems in Mobile Radio Communication.—L. Morris. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 644–649.)

SUBSIDIARY APPARATUS

621-526 **3287**

Dimensionless Analysis of Servomechanisms by Electrical Analogy.—S. W. Herwald & G. D. McCann. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, p. 1132.) Discussion on 543 of February.

621-526 **3288**

Parallel Circuits in Servomechanisms.—H. T. Marcy. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, p. 1128.) Discussion on 3763 of 1946.

621-526 **3289**

The Frequency Response of Automatic Control Systems.—H. Harris, Jr. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1131–1132.) Discussion on 3764 of 1946.

621-526 **3290**

High-Performance Demodulators for Servomechanisms.—K. E. Schreiner. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 393–403.)

621.313.2 **3291**

The "Electrotor".—J. V. Eurich. (*Electronic Engng*, May 1947, Vol. 19, No. 231, pp. 160–161.) For another account of this equipment see 2943 of September.

621.317.755 **3292**

Trends in Cathode-Ray Oscillograph Design.—Gaines. (*See* 3191.)

621.318.3 **3293**

A.C. Magnets and Solenoids.—L. T. Rader. (*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 487–492.) The design and construction of single phase a.c. magnets. Their advantages over d.c. magnets are briefly discussed.

621.318.5 **3294**

Telephone Relays — and Their Use in Electronic Circuits : Part 1.—A. A. Chubb. (*Electronic Engng*, June 1947, Vol. 19, No. 232, pp. 172–177.) The operating conditions of common types of relay are described and the load-line method of matching a relay to a valve is discussed. To be continued.

621.352.8 **3295**

Characteristics of the Silver Chloride-Magnesium Water Activated Battery.—J. B. Mullen & P. L. Howard. (*Electrochemical Society, Preprint* 90–33, pp. 411–422.) The full account of a new type of cell referred to in 2948 of September.

TELEVISION AND PHOTOTELEGRAPHY

537.291 + 538.691] : 621.385.832 **3296**

Electron Optics of Deflection Fields.—R. G. E. Hutter. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 424–453.)

621.397.3 **3297**

Simultaneous All-Electronic Color Television.—RCA Laboratories Division. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 459–468.) The first progress report on the new system which enables the three colour images to be transmitted simultaneously. Each colour channel employs the same standards as are in use for black and white transmission, so that the green channel can transmit monochrome pictures. Undesirable obsolescence is thus avoided, as the system can be interchanged with ordinary black-and-white television.

Apparatus for scanning colour slides and colour motion picture film is described in detail, and the construction of the receivers used in the experimental work is explained.

621.397.44 **3298**

Television Relaying.—P. H. Reedy. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 18–21.) Summary of a Rochester Fall Meeting paper. Colour television relaying by means of cable and radio. Tests on short-range transmissions are outlined and a description of a 530-Mc/s relay transmitter is given. Long-distance cable tests indicate the superiority of colour over black and white, despite bandwidth limitations.

621.397.5 **3299**

A Report on the 1946 Rochester Fall Meeting.—L. Winner. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 18–25 . . 51.)

621.397.5 **3300**

Television as a Public Service.—R. F. Guy. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 21–22.) Summary of a Rochester Fall Meeting paper.

621.397.5 **3301**

Television.—(*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 641–655.) A list of some 275 papers published by R.C.A. authors from 1929–1946 on television and related subjects.

621.397.5 : 621.318.572 **3302**

Counter-Timer for Television.—C. E. Hallmark. (*Communications*, March 1947, Vol. 27, No. 3, p. 14.) Summary of 1947 I.R.E. Convention paper.

621.397.5 : 621.396.67 **3303**

Load Characteristics of Television Antenna Systems : Part 3.—G. E. Hamilton & R. K. Olsen. (*Communications*, March 1947, Vol. 27, No. 3, pp. 20 . . 25.) Aerial impedance characteristics are discussed and phasing and matching methods for transmitting aerials are given, with particular reference to (*a*) the doughnut type of folded dipole with elements of the same or unequal diameter, (*b*) a double-folded system in turnstile, and (*c*) three-element folded dipoles. Where many measurements are found necessary and the complex nature of the load must be plotted, transmission line charts may be used to simplify the calculation. Suitable charts are " Chart for Transmission Line Measurements and Computations", by P. S. Carter, (*RCA Review*, Jan. 1939); " Practical Analysis of Ultra-High-Frequency", by J. R. Meagher & H. J. Markley, (RCA Service Co.) and " Transmission Line Calculator", by P. H. Smith, (*Electronics*, Jan. 1939.) For parts 1 and 2 see 2262 of July.

621.397.5 : 621.396.67 **3304**

Television Antenna Installations giving Multiple Receiver Outlets.—Ehret. (*See* 3029.)

621.397.6 **3305**

Television Deflection Circuits : Part 1 — Molded Iron Dust Cores for Use in Horizontal [line] **Deflection Circuits. Part 2 — Theory and Design of Combined Low-Loss Horizontal Deflecting and High Voltage Power Supply Systems.**—A. W. Friend. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 98–138.) Part 1 : A low-loss, inexpensive system using compressed sponge-iron cores for transformers and yokes enables line deflection to be obtained for a 27-kV kinescope from two Type 807 valves. Curves of the properties of the core material, photographs of typical yokes and transformers and circuit details are given. Part 2 : A complete analysis with design equations and charts.

621.397.6 **3306**

The Use of Powdered Iron in Television Deflecting Circuits.—A. W. Friend. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 89–114.) A shortened version of 3305 above.

621.397.6 **3307**

Westinghouse Color Television Studio Equipment.—D. L. Balthis. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 27–39.) A descriptive account of the electrical and optical equipment required to convert a 35-mm colour slide, or a 16-mm colour film and its associated sound into signals suitable for an u.h.f. colour television transmitter (480–920 Mc/s). The colour operation is based on the use of three primary colours with sequential scanning by means of colour filters. Sound and picture signals are transmitted on the same frequency.

621.397.6 : 621.398 **3308**

Television Equipment for Guided Missiles.—C. J. Marshall & L. Katz. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 115–129.)

621.397.6 : 629.135 **3309**

Television Equipment for Aircraft.—M. A. Trainer & W. J. Poch. (*RCA Rev.*, Dec. 1946, Vol. 7, No. 4, pp. 469–502.) A light-weight airborne television equipment operating on a frequency of about 100 Mc/s is described, and the design considerations involved are listed and discussed. The transmitter and camera are enclosed in a single unit which, together with a monitor and power supply, comprises the transmitting station.

Flight tests of the equipment showed difficulties peculiar to the transmission of television signals from aircraft ; methods used for minimizing these difficulties are discussed. In particular instability of synchronization was overcome by use of a keyed automatic volume control and difficulties due to multi-path transmission from one plane to another by keeping the frequency modulation of the transmitter to a mimimum.

621.397.61 **3310**

High Power Television Transmitters — Some Aspects of Their Design : Parts 1 & 2.—P. A. T. Bevan. (*Electronic Engng*, May & June 1947, Vol. 19, Nos. 231 & 232, pp. 138–142 & 181–184, 204.) Considers the problems associated with peak power outputs up to 50 kW, involving bandwidths up to ± 5 Mc/s, with special reference to the B.B.C. 405-line system. Wide bandwidth requires ' maximally flat ' coupled circuits of low *Q* and this implies a low anode load resistance for the amplifier valve, thus limiting the power output and anode conversion efficiency. Recent short single-ended water cooled valves such as the CAT21 give the small grid-lead inductance required for neutralized push-pull grid-modulated amplifiers at 50 Mc/s. The estimated peak power of a CAT21 is shown graphically in terms of the bandwidth response. The requirements for capacitors, insulators and resistors are briefly described. After expressing the need for more accurate measurement of large currents in v.h.f. tank circuits, the idealized linear operating conditions of a grid-modulated push-pull r.f. amplifier are illustrated and the requirements for neutralization are given. Methods described for overcoming the effects of non-linearity include loading the grid circuit of the modulated amplifier with resistance and the use of a cathode-follower driver stage. The advantages and disadvantages of the grounded-grid r.f. amplifier, and the requirements for output transmission lines and cables are described.

621.397.61 **3311**

Television Transmitter for Black-and-White and Color Television.—N. H. Young. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 40–53.) A general description of a 490-Mc/s transmitter giving a peak power output of 1 kW. It is designed for operation from 3-phase 60-c/s mains at either 208 or 220 V. The total power consumption is 25 kVA.

621.397.611 **3312**

The Electrostatic [image] **Dissector.**—H. Salinger. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 82–88.) Magnetic focusing is used, but scanning is done by electrostatic deflection. The deflection is achieved by means of a number of wires (twelve in this case) disposed axially inside the tube. The two scanning saw-tooth voltages are applied in different proportions to each wire. Special networks to effect proper voltage distribution have been developed.

621.397.62 **3313**

A Simple and Practical Television Receiver.—M. Mars. (*Télévis. franç.*, April 1947, No. 24, pp. 15–17.) Circuit diagrams and constructional details of a receiver using only 18 valves, including the three rectifiers in the supply unit. Sensitivity can be improved by the addition of another h.f. stage.

621.397.62 **3314**

Color Television for Theatres.—H. G. Shea. (*Tele-Tech*, June 1947, Vol. 6, No. 6, pp. 44–45.) General principles of a R.C.A. system giving pictures $7\frac{1}{2}$ ft × 10 ft. The colours are obtained by special phosphors in the three c.r. tubes. See also 1246 of April.

621.397.62 **3315**
Television Sound Channels.—R. B. Dome. (*Communications*, Dec. 1946, Vol. 26, No. 12, pp. 22–25.) Summary of a Rochester Fall Meeting paper. A television receiver using a single wide-band i.f. amplifier for both sound and vision signals. Final separation depends on the frequency difference between sound and vision channels.

621.397.62 : 621.396.662.2 **3316**
Variable Inductance Tuning for TV Receivers.—Melvin. (*See* 3073.)

621.397.743 **3317**
Television Network Facilities.—L. G. Abraham & H. I. Romnes. (*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 477–482.) A discussion on the use of (*a*) balanced wire pairs, (*b*) coaxial cables, and (*c*) radio relays for the interconnection of television studios.

621.397.81 : 621.396.11.029.6 **3318**
Analyzing TV Propagation at U.H.F.—Wakeman. (*See* 3256.)

621.397.81 : 621.396.81.029.63 **3319**
Results of Field Tests on U.H.F. (490 Mc/s) Color Television Transmissions in the New York Metropolitan Area.—Lodge. (*See* 3258.)

621.397.5 **3320**
Television : Vols. 3 & 4. [Book Notice]—A. N. Goldsmith, A. Van Dyck, R. S. Burnap, E. T. Dickey & G. M. K. Baker (Eds.). Radio Corporation of America, Princeton, N.J. A collection of papers dealing with all aspects of television. Volumes 1 & 2 are now out of print, but summaries of the papers in them are included in Volume 3, which covers the period 1938–1941. Volume 4 covers the period 1942–1946.

TRANSMISSION

621.316.726.029.64.078.3 **3321**
Microwave Frequency Stability.—A. E. Harrison. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 615–622.) A discussion of the principles of operation of klystron frequency multipliers and power amplifiers for direct crystal control of the microwave power.

621.396.61 : 621.396.662.1 **3322**
Mono-Sequence Tuning.—J. N. Whitaker. (*Radio News*, June 1947, Vol. 37, No. 6, pp. 44–45..92.) A full description of a single-dial tuning system for the oscillator and frequency multiplier stages of a multiband transmitter, using identical variable capacitors. Circuit details are given.

621.396.61 : 621.396.97 **3323**
2-Control 250-W A.M. Broadcast Transmitter.—H. Kees. (*Communications*, March 1947, Vol. 27, No. 3, pp. 11–13, 37.) A design with only one tunable r.f. circuit, simplified metering and controls, and accessible components.

621.396.61.029.5 **3324**
Transmitter with Efficient Band Switching.—R. P. Turner. (*Radio News*, June 1947, Vol. 37, No. 6, pp. 53–55..150.) The coils for the range 10–80 m are mounted on a sliding carriage, with rack and pinion operation from the front panel, which carries all controls.

621.396.61.029.5/.62] : 621.396.933 **3325**
Ground-Air Communications Unit.—S. A. Meacham. (*Communications*, April 1947, Vol. 27, No. 4, pp. 22–23..54.) A medium-power transmitter covering the bands 125–525 kc/s, 2–20 Mc/s and 100–160 Mc/s.

621.396.611.21.029.56/.58 **3326**
A Table-Top Kilowatt.—G. Grammer, D. Mix & B. Goodman. (*QST*, May 1947, Vol. 31, No. 5, pp. 13–19 . . 154.) Triode-tetrode crystal oscillator and frequency multiplier drive an 813 push-pull amplifier. With input of 1 kW, output of 600 W is obtained at all amateur frequencies from 3.5–30 Mc/s.

621.396.619.13/.14 **3327**
Low-Frequency N.F.M. [narrow-band frequency modulation]**.**—B. Goodman. (*QST*, July 1947, Vol. 31, No. 7, pp. 21–27.) Comparison with narrow-band phase modulation and description of a simple phase modulator.

VALVES AND THERMIONICS

537.533.7+621.385.1 **3328**
Electron Optics and Space Charge in Strip-Cathode Emission Systems.—O. Klemperer. (*Proc. phys. Soc.*, 1st March 1947, Vol. 59, No. 332, pp. 302–323.) For small emission, electron-optical laws can be applied. Simple space charge theory does not hold for special systems of the type proposed by Pierce (4275 of 1940 and back references). In these systems, the potential distribution in the beam causes a lack of homocentricity, revealed by ray-tracing results.

621.383 **3329**
Spontaneous Fluctuations of Current in a Photo-Electric Cell.—D. K. C. MacDonald. (*Nature, Lond.*, 3rd May 1947, Vol. 159, No. 4044, pp. 608–609.) Graphical presentation of the results of shot-effect measurements, with brief discussion.

621.383 **3330**
Photodetectors for Ultraviolet, Visible and Infra-red Radiation.—R. J. Cashman. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 171–180.) Review of recent developments, including (*a*) photoemissive cells with activated and pure metal cathodes, (*b*) photovoltaic cells as used in exposure meters, and (*c*) photoconductive cells and their uses.

621.383 : 522.615 **3331**
Application of the Multiplier Phototube to Astronomical Photoelectric Photometry.—G. E. Kron. (*Astrophys. J.*, May 1946, Vol. 103, No. 3, pp. 326–331.) Characteristics of 1P21 multiplier phototube, which is many times superior to light-sensitive units previously used in the blue region of the spectrum.

621.383.5 : 621.318.57]+621.383.5.001.8 **3332**
The A.C. Behaviour of the Barrier Layer Photo Cell.—J. A. Sargrove. (*J. Brit. Instn Radio Engrs*, May/June 1947, Vol. 7, No. 3, pp. 86–97.) When the cell is illuminated, it acts as a non-linear conductor to current in both directions,

whereas in darkness it behaves as a rectifier. This property enables the cell to be used directly for operating relays, with a sensitivity some 300 times greater than when used as a detector. A high degree of electrical stability is obtained by operating the cell from the same a.c. supply as the lamp which illuminates it. A number of industrial applications of the method are described.

621.385 **3333**

Similitude of Valves.—F. H. Raymond. (*Onde élect.*, May 1947, Vol. 27, No. 242, pp. 209–212.) A demonstration of the agreement between the general theory of similitude and the technical aspect of its application to valves described by Lehmann (3821 of 1946). The similitude of valves with a common cathode is considered in particular, the possibility of other types of similitude is discussed and the law of similitude for the magnetron derived simply.

621.385 : 620.163 **3334**

Electrical Production Tests for High-Power Tubes.—B. Sheren. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 250–255.)

621.385 : 620.163 **3335**

Production Test Facilities for High-Power Tubes.—W. L. Lyndon. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 256–267.) R.C.A. equipment for testing modern high-power valves. It consists of a 25-Mc/s oscillator unit, a 1.5-Mc/s oscillator unit, and associated dummy loads, power supplies, sub-station, control and water-cooling equipment.

621.385.029.63/.64] : 538.3 : 621.396.694 **3336**

On the Helix Circuit used in Progressive-Wave Valves.—Roubine. (*See* 3036.)

621.385.1 + 621.396.611.4 **3337**

F.M./TV P-A Tube and Grounded-Grid Cavity Circuit.—H. D. Wells & R. I. Reed. (*Communications*, March 1947, Vol. 27, No. 3, p. 16.) Summary of 1947 I.R.E. Convention paper.

621.385.1 : 517.54 **3338**

Conformal Transformations in Orthogonal Reference Systems.—Roys. (*See* 3171.)

621.385.1 : 621.396.813 **3339**

Microphony of Radio Valves.—Chamagne & Guyot. (*Télévis. franç.*, April 1947, No. 24, Supplement *Électronique*, pp. 7–10.) Discusses definition and gives methods of measurement.

621.385.1 : 621.396.813 **3340**

Microphonism in a Subminiature Triode.—V. W. Cohen & A. Bloom. (*Communications*, March 1947, Vol. 27, No. 3, pp. 18 . . 41.) Summary of 1947 I.R.E. Convention paper.

621.385.1.032.216 : 546.431.284 **3341**

A Study of the Barium Silicate Interface of Oxide Coated Cathodes.—Eisenstein. (*See* 3158.)

621.385.16 + 621.396.615.141.2 **3342**

The Donutron. An All-Metal Tunable Squirrel-Cage Magnetron.—F. H. Crawford & M. D. Hare. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, p. 623.) Summary only. For another account see 947 of March.

621.385.2 **3343**

Total Emission Noise in Diodes.—A. van der Ziel & A. Versnel. (*Nature, Lond.*, 10th May 1947, Vol. 159, No. 4045, pp. 640–641.) Measurements at λ 7.25 m on a diode with negative anode voltage show that the equivalent noise temperature of the conductance is approximately equal to the cathode temperature; this relationship is expected to hold over a wide frequency range.

621.385.2 **3344**

Total Emission Damping in Diodes.—A. van der Ziel. (*Nature, Lond.*, 17th May 1947, Vol. 159, No. 4046, pp. 675–676.) Results of measurements at λ 5.8 m of the additional admittance in a diode due to the space charge are given in curves which show the dependence of the admittance on the anode voltage and the saturation current. See also 3109 of 1946 (Smyth).

621.385.3 : 621.396.694.012.8 **3345**

The Equivalent Diode.—J. Eastabrook. (*Wireless Engr*, June 1947, Vol. 24, No. 285, pp. 188–189.) It is concluded that experimental discrimination between the formulae of Walker (949 of March) and Tellegen (*Physica*, 1925, Vol. 5, p. 301) is not possible; between these two and Fremlin's (3166 of 1939) it is possible but unimportant. Walker's approach is preferred on account of its simplicity and because it is theoretically sounder and does not involve the three-halves law. See also 2622 and 2623 of August.

621.385.832 : [537.291 + 538.691 **3346**

Electron Optics of Deflection Fields.—R. G. E. Hutter. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 424–453.)

621.396.615.14 **3347**

The Generator of Centimeter Waves.—H. D. Hagstrum. (*Proc. Inst. Radio Engrs, W. & E.*, June 1947, Vol. 35, No. 6, pp. 548–564.) The physical principles and performance of three types of cavity-resonator magnetron oscillator are described and discussed in some detail. Disk-seal triodes (with built-in cavity-resonators) and velocity-variation oscillators are described briefly. References to basic papers are given.

621.396.615.14 + 621.385.1].029.63/.64 **3348**

The Generation of Ultra-High-Frequency Power at the Fifty-Kilowatt Level.—W. G. Dow & H. W. Welch, Jr. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 603–614.) A comprehensive description of the cavity and electrode structures of the resnatron. The effects of transit time are considered with special reference to frequency stability. See also 1732 of 1946 (Salisbury).

621.396.615.141.2 **3349**

A Magnetron Oscillator with a Series Field Winding.—L. H. Ford. (*J. Inst. elect. Engrs*, Part I, April 1947, Vol. 94, No. 76, pp. 187–188.) Summary of 2631 of August.

621.396.615.141.2 : 621.396.645.35 **3350**

A Magnetron for D.C. Voltage Amplification.—H. B. G. Casimir. (*Philips tech. Rev.*, Dec. 1946, Vol. 8, No. 12, pp. 361–367.) Use of diode in which magnetic field is excited by input circuit; input and output circuits thus separated; introduction of grid at cathode potential near anode increases magnetic sensitivity, which is comparable with the amplification factor of a triode.

621.396.615.141.2 : 621.396.822 **3351**

Excess Noise in Cavity Magnetrons.—Sproull. (*See* 3268.)

621.396.615.142 **3352**

Velocity Modulation : Parts 1 & 2.—J. H. Fremlin. (*Electronic Engng*, May & June 1947, Vol. 19, Nos. 231 & 232, pp. 147–151 & 199–201.) A general discussion of the various types of tubes. The conditions for oscillation in the Heil tube are derived and it is shown how the power from the electron beam in a rhumbatron varies with the oscillation amplitude. The methods for increasing bunching efficiency using the reflex klystron oscillator are compared and the mechanism of bunching for different field distributions using a reflector at high negative potential is explained with the aid of mechanical analogies. By considering the voltage and current conditions in the working gap it is shown how instantaneous frequency changes are effected in a klystron by variation of the high voltage or in a reflex oscillator by variation of the reflector potential.

621.396.615.142 **3353**

Velocity-Modulation Valves.—F. M. Penning. (*Philips tech. Rev.*, July 1946, Vol. 8, No. 7, pp. 214–224.) A theoretical discussion of the principles involved in their use as amplifiers and as oscillators.

621.396.615.142 + 621.392.029.64] : 538.56 **3354**

Generalized Boundary Conditions in Electromagnetic Theory.—Schelkunoff. (*See* 3094.)

621.396.615.142.2.029.64 **3355**

The Klystron as Amplifier at Centimetric Wavelengths.—R. Kompfner. (*J. Brit. Instn Radio Engrs*, May/June 1947, Vol. 7, No. 3, pp. 117–123. Discussion, pp. 123–124.) It is shown that in theory a klystron is capable of giving r.f. amplification ; a detailed examination shows that noise is the limiting factor. The reduction of shot noise by suitable design is discussed briefly but it is concluded that the practical difficulties in the case of the klystron are much greater than for other devices.

621.396.694 **3356**

Empirical Formula for [valve] **Amplification Factor.**—E. W. Herold. (*Proc. Inst. Radio Engrs, W. & E.*, May 1947, Vol. 35, No. 5, p. 493.) A simple formula based on Herne's table (2210 of 1944). See also 2406 of 1946 (Liebmann).

621.396.694 **3357**

Triode Characteristics.—S. Rodda. (*Wireless Engr*, May 1947, Vol. 24, No. 284, p. 157.) Method of calculating the equivalent grid voltage of a triode. A first approximation gives a result in agreement with that of Tellegen ; a second approximation includes the effect of space charge in the grid-anode region.

621.383 **3358**

Photoelectric Cells. [Book Review]—A. Sommer. Methuen & Co., 104 pp., 5s. (*P.O. elect. Engrs' J.*, Jan. 1947, Vol. 39, Part 4, p. 180.) Describes the theory of photoemission, the properties of commercial photoelectric cathodes, the matching of light sources and photocathodes, the mechanism of gas amplification and multiplier cells, and applications.

MISCELLANEOUS

061.3 : 621.39 **3359**

A Report on the 1947 I.R.E. National Convention.—(*Communications*, March 1947, Vol. 27, No. 3, pp. 14–16..43.) For titles of some of the papers read see individual sections.

061.6(54) : 666 **3360**

Central Glass and Ceramic Research Institute, India.—Y. P. Varshney. (*Nature, Lond.*, 1st March 1947, Vol. 159, No. 4035, pp. 290–292.) A description covering the functions of, and facilities to be provided by, the Institute which is in process of erection at Calcutta.

5 + 6] : 016 **3361**

Bibliography of Scientific and Industrial Reports.—A weekly publication by the U.S. Department of Commerce, giving abstracts of reports and patents dealing with electronics, plastics, electrical machinery, equipment and supplies, instruments, metals and metal products, physics, and other subjects.

5 : 3 **3362**

Science, Politics, and the National Welfare.—F. L. Hovde. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 15–19.)

5 : 6 **3363**

Physics of To-day becomes the Engineering of To-morrow.—C. G. Suits. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 20–26.) A discussion of developments resulting from physical research, illustrated by special reference to the magnetron. See also *Elect. Engng, N.Y.*, March 1947, Vol. 66, No. 3, pp. 241–243.

538.3 : 001.5 **3364**

The Electric-Magnetic Analogy.—G. W. O. H. : G. H. Livens. (*Wireless Engr*, May 1947, Vol. 24, No. 284, pp. 131–132 & 156.) Comment on 970 of March. Various manipulations of the Lagrangian and Hamiltonian functions L and A for both electric and magnetic fields tend to show that in some cases E is analogous to B rather than to H, while D ($= P + E/4\pi$, where P is the material polarization) is analogous to H rather than to B.

The advantages and disadvantages of exchanging the roles of the vectors B and H are discussed.

539 Rutherford **3365**

Rutherford : Life and Work after the Year 1919, with Personal Reminiscences of the Cambridge Period.—J. D. Cockcroft. (*Proc. phys. Soc.*, 1st Nov. 1946, Vol. 58, No. 330, pp. 625–633.) The second Rutherford Memorial Lecture.

539 Rutherford **3366**

Rutherford and the Modern World.—M. L. Oliphant. (*Proc. phys. Soc.*, 1st Jan. 1947, Vol. 59, No. 331, pp. 144–155.) The third Rutherford Memorial Lecture.

539.1 : 62 **3367**

Atoms, Electrons and Engineers.—T. E. Allibone. (*J. Instn elect. Engrs*, Part I, April 1947, Vol. 94, No. 76, pp. 165–171.) The Faraday Lecture. Salient features of modern atomic theory. Common substances and processes used in engineering are examined in the light of this theory. Uranium fission and its applications are described.

614.825 **3368**

Dangerous Electric Currents.—C. F. Dalziel. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1946, Vol. 65, pp. 1123–1124.) Discussion on 310 of January.

621.3.016.25 **3369**

The Sign of Reactive Power.—(*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, pp. 514–517.) Sixteen further comments on 971 of March. See also 1972 of June.

621.3 "1920/1946" **3370**

A Synoptic Review of Electrical Engineering Progress, particularly during the Last Quarter Century.—J. D. Ferguson. (*J. Instn elect. Engrs*, Part I, Feb. 1947, Vol. 94, No. 74, pp. 73–81.) Abstract of Chairman's address to Irish branch of I.E.E.

621.38/.39 **3371**

Electronics and the Future.—E. U. Condon. (*Proc. nat. Electronics Conference, Chicago*, Vol. 2, pp. 1–14.) The opening address at the Conference.

621.38/.39 **3372**

Some Aspects of Electronic Engineering.—T. P. Allen. (*J. Instn elect. Engrs*, Part I, Feb. 1947, Vol. 94, No. 74, pp. 113–115.) Abstract of Chairman's address to Northern Ireland Centre of I.E.E.

621.395 : 061.24 C.C.I.F. **3373**

The 14th Plenary Session of the Comité Consultatif International Téléphonique (C.C.I.F.) in Montreux, 21st-31st October 1946.—W. Schiess. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st April 1947, Vol. 25, No. 2, pp. 73–82. In German.) A general account of the proceedings.

621.396 **3374**

Scientific Problems of Contemporary Radio.—N. D. Papalexi. (*Vestnik Akad. Nauk, S.S.S.R.*, 1946, No. 7, pp. 9–15. In Russian.)

621.396 **3375**

[Radio Society of Great Britain] **Presidential Address.**—S. K. Lewer. (*Proc. R.S.G.B.*, Spring 1947, No. 1, pp. 1–6.) Discusses the revival of obsolete radio techniques to solve new problems.

621.396 : 06.053 URSI **3376**

Summary Report of the Seventh General Assembly of the International Scientific Radio Union (URSI) in Paris, September 27-October 25, 1946.—Newbern Smith. (*Terr. Magn. atmos. Elect.*, March 1947, Vol. 52, No. 1, pp. 80–83.) Statement of resolutions adopted. For a summary of selected papers read at the Conference, see 2758 of September.

621.396 "1939/1946" **3377**

Radio-Communication Developments.—(*Wireless World*, May 1947, Vol. 53, No. 5, pp. 158–160, 181.) Report of the I.E.E. Radio-Communication Convention of March 1947 which covered advances made since 1939.

621.396.1.029 **3378**

Proposed Frequency Band Designations.—(*Elect. Engng, N.Y.*, May 1947, Vol. 66, No. 5, p. 471.) Explanation, by the technical committee on standard frequency bands, of a 'decade frequency system' in which the designation of each band is the characteristic of the logarithm to base 10 of all the frequencies within the band. Band 5, for example, includes frequencies from 10^5 to 10^6 c/s. See also 3742 of 1945.

621.396.97 : 621.396.82 **3379**

The War of Broadcasting.—E. Wolf. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st April 1947, Vol. 25, No. 2, pp. 64–72. In German and French.) Discusses the part played by broadcasting during the war and describes the development of methods of attack and defence, from simple jamming of enemy transmissions to intrusion on the single sideband of the enemy carrier wave.

491.7-3 = 2 **3380**

Russian - English Technical and Chemical Dictionary. [Book Review] — L. I. Callaham. John Wiley & Sons, New York, 794 pp., $10.00. (*Amer. J. Sci.*, July 1947, Vol. 245, No. 7, p. 463.) The book leans towards chemistry, but nearly every natural science, medicine, mathematics, engineering, etc., receives some attention.

621.38/.39 **3381**

Proceedings of the National Electronics Conference, Vol. 2. [Book Notice]—R. E. Beam (Ed.). Electrical Engineering Department, Northwestern University, Evanston, Illinois, 1947, 741 pp., $3.50. A collection of papers presented at the Second National Electronics Conference held at Chicago, 3rd–5th Oct. 1946. For abstracts of selected individual papers, see other sections.

621.396 **3382**

Radio's Conquest of Space. [Book Review]—D. McNicol. Murray Hill Books Inc., 364 pp., $4.00. (*Electronic Engng*, June 1947, Vol. 19, No. 232, p. 202.) The author traces " the evolution of radio as a disinterested observer . . . This is a good book and an authoritative book."

621.396 **3383**

Reference Data for Radio Engineers. [Book Review]—W. L. McPherson. Standard Telephones and Cables, London, 175 pp., 5s. (*Overseas Engr*, March 1947, Vol. 20, No. 234, p. 278.) " It consists of a series of tables which list mathematical theorems and short reminders of essential definitions. It is profusely illustrated with curves and diagrams relating to every important aspect of radio engineering."

621.396 **3384**

Second Year Radio Technology. [Book Review]—W. H. Date. Longmans, Green & Co., London, 222 pp., 7s. 6d. (*Elect. Rev., Lond.*, 22nd Aug. 1947, Vol. 141, No. 3639, p. 304.)

621.396 **3385**

The Radio Amateurs' Handbook. [Book Review]—Headquarters Staff of the American Radio Relay League. American Radio Relay League, West Hartford, Conn., 24th edn 1947, 470 pp., $1.25 in U.S.A., $2.00 elsewhere. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, p. 707.) For review of 1946 edition see 1303 of April. The section on equipment construction is revised, and information on the mechanical construction of aerials has been added.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **3386**

References to Contemporary Papers on Acoustics.—A Taber Jones. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 374–388.) Continuation of 2306 of August.

534.21 **3387**

The Propagation of an Acoustic Wave along a Boundary.—I. Rudnick. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 348–356.) The sound field of a point source near the boundary of two media cannot be obtained by assuming plane waves and using the plane wave reflection coefficient. A more rigorous solution is obtained similar to that given by Sommerfeld for the analogous electromagnetic case. The discussion of the solution is restricted to cases in which the sound source is at the boundary. It is shown that when the boundary medium has a high real specific acoustic impedance, non-zero fields are obtained at all points along the boundary. Calculations of the sound pressure as a function of height, when the media are air above and Quietone (an absorbing material) below, reveal a minimum some distance above the boundary.

534.213 **3388**

Propagation of Sound through a Liquid containing Bubbles.—E. L. Carstensen & L. L. Foldy. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 481–501.) "Experimental data on the transmission, scattering, and reflection of sound by screens of bubbles are presented and shown to agree with theory. A parameter, related to the damping of acoustic energy by bubbles and which cannot be satisfactorily predicted from theory, is evaluated empirically from the data."

534.231 : 621.396.11 **3389**

A Device for plotting Rays in a Stratified Medium.—A. W. Lawson, P. H. Miller, Jr, & L. I. Schiff. (*Rev. sci. Instrum.*, Feb. 1947, Vol. 18, No. 2, pp. 117–120.) A description of an instrument used during the war for the computation of sound fields in water; it could also be applied to the propagation of radar signals in a stratified atmosphere.

534.26 **3390**

Sound Diffraction by Rigid Spheres and Circular Cylinders.—F. M. Wiener. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 444–451.) Measurements with a probe microphone gave agreement with theory for a sphere over the range $1/3<ka<10$ where k is the wave number of the incident wave and a the radius. Similar results were obtained for a cylinder. Tables of results are given for the cylinder showing the magnitude and phase of the pressure at the surface of the obstacle relative to the undisturbed sound pressure.

534.321.9 **3391**

Measurement and Specification of Ultrasonic Lenses.—P. J. Ernst. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, p. 474.) Methods analogous to those approved in optics are suggested.

534.321.9 : 621.317.49 **3392**

Comparison of Supersonic Intensities by means of a Magnetostriction Gauge.—Smith & Weimer. (*See* 3580.)

534.321.9 : [666.1 + 669.71 **3393**

Attenuation and Scattering of High Frequency Sound Waves in Metals and Glasses.—W. P. Mason & H. J. McSkimin. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 464–473.)

534.322.1 : 621.395.623.8 **3394**

Identification of Musical Instruments when heard directly and over a Public-Address System.—H. V. Eagleson & O. W. Eagleson. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 338–342.) Comparison of the success of two groups of musicians and one group of non-musicians in identifying nine different musical instruments (*a*) directly and (*b*) over a public-address system.

534.41 + 534.781 **3395**

The Portrayal of Visible Speech.—J. C. Steinberg & N. R. French. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 215.) Summary of 3516 of 1946.

534.41 + 534.781 **3396**

The Sound Spectrograph.—W. Koenig, H. K. Dunn & L. Y. Lacy. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 214.) Summary of 3517 of 1946.

534.41 + 534.781] : 535.37 **3397**

Visible Speech Translators with External Phosphors.—H. Dudley & O. O. Gruenz, Jr. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 213.) Summary of 3519 of 1946.

534.41 + 534.781] : 621.385.832 **3398**

Visible Speech Cathode-Ray Translator.—R. R. Riesz & L. Schott. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 214.) Summary of 3520 of 1946.

534.417 : 620.193.85 **3399**

Some Acoustic Properties of Marine Fouling.—J. W. Fitzgerald, M. E. Davis & B. G. Hurdle. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 332–337.) Quantitative measurements of the acoustic effects of fouling of underwater transducers by marine organisms. The acoustic attenuation of certain anti-fouling paints is found to be negligible.

534.43 : 621.395.61 **3400**

Measurement of Mechanical Compliance and Damping of Phonograph Pick-Ups.—B. B. Bauer. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 319–321.) The apparatus described can be adapted to measure vertical as well as lateral compliance and resistance of pickups, and the mechanical impedance of certain types of structures and damping materials.

534.612.4 **3401**

Measurement of Electromotive Force of a Microphone.—R. K. Cook. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 503–504.) A discussion of the conditions under which, in the substitution method, the calibrating voltage equals the microphone e.m.f. The analysis is limited to a linear electromechanical transducer operated at a frequency low enough to permit the use of lumped parameters.

534.64 **3402**

Some Notes on the Measurement of Acoustic Impedance.—L. L. Beranek. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 420–427.) A modified form of an earlier impedance tube (1410 of 1942) is described, capable of measuring the normal impedance of a sample by the variable length, variable frequency or travelling microphone methods. Diagrams are given for the graphical calculation of the impedance from the measurements.

534.78 : 621.396.645 **3403**

The Theory and Design of Speech Clipping Circuits.—Dean. (*See* 3477.)

534.782 **3404**

On an Artificial Voice for Acoustic Measurements.—P. Chavasse. (*C. R. Acad. Sci., Paris*, 9th June 1947, Vol. 224, No. 23, pp. 1620–1622.) Essentially a source of current with a continuous and uniform spectrum, formed by a neon tube working in a zone of unstable equilibrium. The tube is polarized by a d.c. voltage through a resistor and capacitor favouring l.f. oscillations. Change from a male voice, with a maximum voltage near 550 c/s, to a female voice, with maximum near 1 100 c/s, is effected by a simple switch.

534.83 : 629.135 **3405**

Acoustical Materials and Acoustical Treatments for Aircraft.—R. H. Nichols, Jr, H. P. Sleeper, Jr, R. L. Wallace, Jr, & H. L. Ericson. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 428–443.) A comprehensive paper on the methods of reducing the cabin noise level. The functional properties of various treatments in attenuating the transmitted sound and in absorbing reverberant sound are considered in detail and a method for estimating the effectiveness of a material from the 'flow resistance' is described.

534.84 **3406**

Acoustical Tests in the Scala Theater of Milan.—E. Paolini. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 346–347.) A short account of tests conducted in the rebuilt theatre. They include tests for echoes, reverberation, articulation and loudness levels.

534.851 + 534.861] : 621.396.813 **3407**

High-Fidelity Reproduction of Music.—E. Toth. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 108–113.) Practical suggestions for reducing various types of distortion which occur in a.m. and f.m. receivers and in gramophone record reproduction.

534.851 : 621.395.625.2 **3408**

A Distortion Reducing Stylus for Disk Reproduction.—E. F. McClain, Jr. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 326–328.)

534.861/.862].1 **3409**

Recording Studio Acoustics.—L. Green, Jr, & J. Y. Dunbar. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 412–414.) Summary noted in 2307 of August. A general discussion, with some details of the treatment of several studios to obtain improved reverberaton characteristics.

534.861/.862].1 **3410**

Convex Wood Splays for Broadcast and Motion Picture Studios.—M. Rettinger. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 343–345.) Summary noted in 2307 of August.

534.861.1 **3411**

A Review of Criteria for Broadcast Studio Design.—H. M. Gurin & G. M. Nixon. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 404–411.) Summary noted in 2307 of August.

534.862.3"1857/1926" **3412**

Historical Development of Sound Films : Parts 1 & 2.—E. I. Sponable. (*J. Soc. Mot. Pict. Engrs*, April 1947, Vol. 48, No. 4, pp. 275–303.) A review covering the period 1857–1926.

621.395.61 **3413**

Mechano-Electronic Transducers.—H. F. Olson. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 307–319.) Summary noted in 2307 of August. See also 2624 of August. A system whereby a voltage is developed by the direct action of acoustical vibrations on one of the electrodes of a valve.

The vibrating element can be made very small, with a low mechanical impedance. Various electrode arrangements are discussed and expressions derived for their electrical characteristics. For small amplitudes the output voltage is proportional to the displacement. Equivalent mechanical circuits are shown and discussed in relation to the amplitude/frequency characteristic. A successful transducer is illustrated, consisting of a small triode in which the anode is the vibrating element. Details are also given of a gramophone pickup and two microphones. Their response characteristics are derived theoretically from the equivalent mechanical circuits and measured characteristics are shown.

621.395.625.2 **3414**

Technics of Sound Recording with Embossed Groove Methods.—L. Thompson. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 48–51 . . 115.) Discusses the advantages of these methods for business use. Reasonable fidelity and volume are obtained at slow track speed. Photographs and frequency response curves are given.

621.395.625.3 **3415**

Some Factors influencing the Choice of a Medium for Magnetic Recording.—L. C. Holmes. (*J. acoust. Soc. Amer.*, May 1947, Vol. 19, No. 3, pp. 395–403.) Summary noted in 2307 of August. A definition of signal/noise ratio for magnetic recording systems is offered to stimulate discussion. Modulation noise, background noise, cross talk and uniformity are considered. The ratio of coercivity to retentivity is suggested as a figure of merit for evaluating the h.f. response of a recording medium.

621.395.625.3 : 778.5 **3416**

Recent Developments in Magnetic Recording for Motion Picture Film.—M. Camras. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 322–325.)

621.395.625.6 : 534.862.4 **3417**

A New Method of counteracting Noise in Sound-Film Reproduction.—W. K. Westmijze. (*Philips tech. Rev.*, April 1946, Vol. 8, No. 4, pp. 97–104.) When the incident light beam is replaced by a series of equidistant light spots moving with high velocity perpendicular to the sound track, noise arising from dust and scratches on the film is considerably reduced.

621.395.645 : 621.395.614] : 621.395.623.8 **3418**

Microphone Pre-Amplifier.—Selby. (*See* 3457.)

621.395.813 : 621.395.66 : 621.396.97 **3419**

Compensation of Temperature Effects on Music Circuits.—F. J. Stringer & G. Stannard. (*B.B.C. Quart.*, April 1947, Vol. 2, No. 1, pp. 41–50.) An account of apparatus and technique developed by the B.B.C. and G.P.O. to compensate for changes in response characteristics of long-distance line circuits due to seasonal changes in temperature. These changes in response characteristics are calculated theoretically and compared with actual measurements made on particular circuits.

AERIALS AND TRANSMISSION LINES

621.315.687 **3420**

Cable Terminations.—D. B. Irving. (*J. Instn elect. Engrs*, Part II, April 1947, Vol. 94, No. 38, pp. 123–128.) Discussion on 3360 of 1945.

621.392+537.291] : [621.385.029.63/.64 **3421**

On the Theory of Progressive-Wave Amplifiers.—A. Blanc-Lapierre, R. Lapostolle, J. P. Voge & R. Wallauschek. (*Onde élect.*, May 1947, Vol. 27, No. 242, pp. 194–202.) An integration and amplification of previous papers (1317 and 1330 of May, 1999 and 2003 of July).

621.392.029.64 **3422**

Wave-Guide Coupler.—G. Ashdown. (*J. sci. Instrum.*, March 1947, Vol. 24, No. 3, p. 79.) For aligning and joining sections.

621.392.029.64 **3423**

Transmission in Waveguides.—A. M. Woodward. (*Wireless Engr*, July 1947, Vol. 24, No. 286, pp. 192–196.) "The theory of transmission of an H_{01} wave in a rectangular waveguide containing longitudinal slabs of solid dielectric is developed. Formulae are given for phase constant and attenuation which take into account imperfect conductivity of the guide walls as well as losses in the dielectric. Numerical values are given for polythene as dielectric. At high frequencies most of the energy travelling down the guide is confined to the dielectric slabs. The phase constant and attenuation are then nearly equal to their values for a completely-filled guide."

621.392.2 **3424**

Use of [transmission] **Lines as Resonant Circuits.**—A. Fournier. (*Rev. sci., Paris*, 1st/15th Dec. 1946, Vol. 84, Nos. 3262/3263, pp. 624–629.) The lines are considered as having lumped constants and the equations of propagation are derived. Other sections discuss (*a*) characteristic impedance, (*b*) reflection of waves and stationary waves, (*c*) impedance transformation, (*d*) equivalence of quarter-wave line and resonant circuit, (*e*) lines matched to valve capacitances, (*f*) charged lines, (*g*) coupled lines and (*h*) link coupling.

621.396.67 **3425**

Circularly-Polarised Omnidirectional Antenna.—G. H. Brown & O. M. Woodward, Jr. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 259–269.) The combination of a vertical dipole and horizontal loop requires too critical adjustment. Four dipoles spaced around the circumference of a horizontal circle and inclined to its plane give a good approximation. A theoretical discussion is followed by the results of tests over a frequency range of 106–134 Mc/s.

621.396.67 **3426**

Antenna Focal Devices for Parabolic Mirrors.—G. Reber. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 731–734.) The measured characteristics of cone and cylindrical aerials in parabolic mirrors are given. The relationships between geometrical and electrical characteristics are discussed.

621.396.67 **3427**

Gain *vs.* Element Spacing in Parasitic Arrays.—R. G. Rowe. (*QST*, April 1947, Vol. 31, No. 4, pp. 30–35.) Results are given of measurements showing the relation between gain and spacing under controlled conditions and with a definite technique. Wider spacing than is commonly used is shown to give greater gain.

621.396.67 **3428**

Input Impedance of a Folded Dipole.—W. van B. Roberts. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 289–300.) A theoretical discussion of the cases in which the dipole has equal and unequal elements. Consideration is also given to finite spacing of the elements.

621.396.67 : 517.512.2 **3429**

Fourier Transforms in Aerial Theory : Part 2.—Ramsay. (*See* 3561.)

621.396.67 : 621.317.772.029.64 **3430**

Phase-Front Plotter for Centimeter Waves.—Iams. (*See* 3590.)

621.396.67 : 621.396.712 : 621.396.619.13 **3431**

Antennas for F.M. Broadcasting : Part 2.—N. Marchand. (*Communications*, May 1947, Vol. 27, No. 5, pp. 24–26..37.) Discussion of the principles of operation and construction of the clover-leaf, slot, and turnstile aerials. For part 1 see 3030 of October.

621.396.67.002.72 : 621.397.5 **3432**

The WABD Super-Turnstile TV Antenna Installation.—A. W. Deneke. (*Communications*, May 1947, Vol. 27, No. 5, pp. 12–15..38.) Consideration of the factors influencing the installation and testing of an aerial and feeder system on an 80-ft. tower on the roof of a skyscraper.

621.396.67.029.62 : 621.396/.397].62 **3433**

Aerials for Ultra-Short Waves : Part 1 — A Double Dipole for Television and F.M.—R. D. A. Maurice. (*B.B.C. Quart.*, April 1947, Vol. 2, No. 1, pp. 59–62.) The dipole receives 45-Mc/s and 90-Mc/s transmissions simultaneously. Its performance when suitably oriented differs little from that of an ordinary dipole.

621.396.672.029.62 : 621.396.65 **3434**

Aerials for Ultra-Short Waves : Part 2 — A Simple Omnidirectional Aerial with Concentric Feeder.—H. L. Kirke. (*B.B.C. Quart.*, April 1947, Vol. 2, No. 1, pp. 62–64.) An end-fed, vertical $\lambda/4$ folded dipole is used to ensure correct impedance matching to the feeder ; this is particularly important for the receiving aerial in u.s.w. radio links. A circular polar diagram is obtained by means of an 'artificial earth'.

621.396.675 : 550.837 **3435**

Electric Field of an Oscillating Dipole on the Surface of a Two Layer Earth.—A. Wolf. (*Geophys.*, Oct. 1946, Vol. 11, No. 4, pp. 518–534.) "The electric field of a low frequency oscillator placed on the surface of a two layer earth is determined in two special cases, namely, the case in which the conductivities of the two layers are nearly equal, and the case in which the lower layer is a perfect insulator ; in the latter case, only terms of zero and first order in frequency are considered. It is shown that, when the upper layer is sufficiently thin or is very thick, the mutual inductance of two wire elements on the surface of a two layer earth has the same value as for a homogeneous earth. In the case of an insulated layer, it is shown that the maximum departure of the value of mutual inductance of two colinear wire elements from the corresponding value on a homogeneous earth is 35%."

621.396.675 : 550.837 **3436**

Electric Field of an Oscillating Dipole at the Surface of a Two Layer Earth.—W. B. Lewis. (*Geophys.*, Oct. 1946, Vol. 11, No. 4, pp. 535–537.) Discussion of 3435 above. Field measurements of the transverse component E_y of the dipole field show that its value is dependent on frequency, whereas according to Wolf's rigorous solution (above) E_y should be independent of frequency. The experimental results are in agreement with the solution of the problem of a dipole oscillator in a homogeneous medium. The disagreement of the measurements with the more rigorous theory and the agreement with theory that neglects the air-earth boundary is paradoxical.

621.396.679.4 **3437**

Choosing a Transmission Line.—R. M. Purinton. (*QST*, June 1947, Vol. 31, No. 6, pp. 39–44, 118.) A comparison of various types of feeders and considerations governing the choice for particular installations.

621.396.677 : 621.396.97 **3438**

Directional Antennas [Book Review]—C. E. Smith. Cleveland Institute of Radio Electronics, Cleveland, 1946, 298 pp., $15.00. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, p. 706.) ". . . Of particular interest to those concerned with the design of vertical-tower directional antennas for broadcast stations. A thorough, systematic engineering treatment. . . ."

CIRCUITS AND CIRCUIT ELEMENTS

621.314.23 : 621.396.69 **3439**

Toroidal Transformers.—A. L. Morris. (*Electronic Engng*, July 1947, Vol. 19, No. 233, pp. 218–219.) These can effect a considerable saving in space and weight. Special winding machines are required and insulation and winding difficulties may be encountered in high-voltage windings, but toroids are very suitable for multi-winding filament transformers, especially in aircraft equipment where supply frequencies of 400 or 1600 c/s are used and the number of turns in each winding can be correspondingly reduced. Developments in silicon-iron core material may make toroids advantageous for 50 c/s working. For an account of a winding machine, see 3672 below.

621.316.722.1.076.7 **3440**

Diode-Controlled Voltage Regulators.—L. Helterline. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 96–97.) Circuit details of a bridge-type regulator, in which the filament of a temperature-limited diode acts as control element. A.c. output voltage is constant within 0.2% over a 10 : 1 load variation. The stability of a d.c. version equals that of batteries.

621.316.89 + 621.315.59 **3441**

Properties and Uses of Thermistors—Thermally Sensitive Resistors.—J. A. Becker, C. B. Green & G. L. Pearson. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, pp. 170–212.) Reprint of 765 of March.

621.318.323.2.042.15 **3442**

Permeability of Dust Cores.—Legg. (*See* 3555.)

621.318.572 **3443**

Self-Switching R.F. Amplifier.—H. M. Wagner & J. F. Herrick. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 128–131.) A twin pentode multivibrator circuit amplifies and automatically switches two circuits into a common indicator for direction finding purposes. Design considerations, switching ratios and input resistance variations are discussed.

621.318.572 **3444**

Vane-Actuated Controller.—W. H. Wannamaker, Jr. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 117–119.) Movement of a vane between the coils of a double triode r.f. oscillator causes a sudden change of anode current, which actuates an output relay. Full circuit details are given, with several industrial applications.

621.318.572 : 621.317.755 **3445**

A Laboratory Four-Channel Electronic Switch.—F. S. Replogle, Jr, & V. M. Albers. (*Rev. sci. Instrum.*, Feb. 1947, Vol. 18, No. 2, pp. 114–117.) Permits the simultaneous presentation of four signals of frequency up to 100 kc/s on a c.r.o. screen. See also 1780 of 1946 (Moerman).

621.319.53 **3446**

A Simple Pulse Converter for Gas Tube Applications.—L. Reiffel & K. Rothschild. (*Rev. sci. Instrum.*, March 1947, Vol. 18, No. 3, pp. 181–183.) Pulses of either polarity are fed through a resistance network to the screen grid of a thyratron, whose electrodes are biased to give monopolar output pulses. The anode circuit is used to provide pulse shaping.

621.392.2 **3447**

Use of [transmission] **Lines as Resonant Circuits.**—Fournier. (*See* 3424.)

621.392 21 **3448**

On the Short-Circuiting of a Charged Transmission Line.—V. L. Ginzburg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 57–64. In Russian.) A transmission line with uniformly distributed circuit parameters is considered. Initially it is open-circuited and charged. A general equation is derived for the self-oscillations in the line when short-circuited through a loading inductance, and solutions are found for two particular values of this inductance.

621.392.43 : 621.396.615.141.2 **3449**

Microwave Generator.—W. C. Brown. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 59.) Summary of I.R.E. paper. The effect of a mismatched transmission line on the frequency stability and power output of a magnetron is studied by means of an equivalent circuit.

621.392.5 : 621.396.622.6 **3450**

Crystal Networks.—L. Apker, E. Taft & J. Dickey. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 54.) Summary of I.R.E. paper. Discusses the case where the insertion loss of a nonlinear quadripole is different for power transmitted in opposite directions. Results of tests on 20 Si and Ge crystals are given.

621.392.5.015.3 **3451**

Network Distortion.—M. J. DiToro. (*Tele-Tech* May 1947, Vol. 6, No. 5, pp. 55–56.) Summary of I.R.E. paper. The transient response of a network to a step signal may be used as a measure of the distortion to be expected. Curves to facilitate the study of transient response are shown together with design data for correcting networks.

621.392.52 **3452**

A Simplified Analysis of the Parallel-T Null Network.—M. P. Givens & J. S. Saby. (*Rev. sci. Instrum.*, May 1947, Vol. 18, No. 5, pp. 342–346.) "The parallel-T resistance-capacitance null network is analyzed algebraically. General conditions for null, and expressions for network impedance and sharpness of null, are obtained in a convenient form for application to practical design problems. Vector diagrams are used to illustrate the variations of phase and amplitude of output voltage with frequency."

621.392.52 **3453**

Analysis of a Resistance-Capacitance Parallel-T Network and Applications.—A. E. Hastings. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, p. 694.) Correction to 1464 of 1946.

621.394/.397].645 **3454**

Cathode-Follower Circuit.—H. L. Krauss. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, p. 694.) Comment on 1025 of April (McIlroy). See also 1373 of May.

621.394/.397].645 : 518.3 **3455**

Cathode Follower Nomograph for Pentodes.—M. B. Kline. (*Electronics*, June 1947, Vol. 20, No. 6, p. 136.) Gives relation between gain, transconductance and cathode load resistance.

621.394/.397].645.34 **3456**

A Variation on the Gain Formula for Feedback Amplifiers for a Certain Driving-Impedance Configuration.—T. W. Winternitz. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 216.) Summary of 50 of January.

621.395.645 : 621.395.614] : 621.395.623.8 **3457**

Microphone Pre-Amplifier.—R. Selby. (*Wireless World*, July 1947, Vol. 53, No. 7, pp. 239–240.) Cathode-follower circuit suitable for public address work.

621.395.661 **3458**

Mica Capacitors for Carrier Telephone Systems.—A. J. Christopher & J. A. Kater. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 213.) Summary of 374 of February.

621.396.611.3.029.56 **3459**

Coupled-Circuit Oscillators.—D. K. Cheng. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 58–59.) Summary of I.R.E. paper. Measurements of wavelength and loading characteristics of a 2-Mc/s coupled-circuit oscillator show good correlation with theoretical predictions. Conclusions concerning the optimum degree of coupling and magnitude of the external load resistance are stated.

621.396.611.4 **3460**

The Simplest Design Calculations of Certain Cavity Resonators.—V. M. Lopukhin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 111–116. In Russian.) Approximate formulae are derived for calculating the Q and impedance of the following resonators: simple toroidal (Fig. 1), quasi-toroidal (Fig. 2), π type (Fig. 3) and cylindrical (Fig. 4).

621.396.611.4 **3461**

On the Self-Excitation of a Cavity Resonator traversed by an Electron Beam.—S. Gvozdover & V. Lopukhin. (*Bull. Acad. Sci, U.R.S.S., sér.* phys., 1946, Vol. 10, No. 1, pp. 29–36. In Russian.)

621.396.611.4 **3462**

Coupling between Cavity Resonators through Small Apertures.—V. B. Brodski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 17–22. In Russian.) A mathematical investigation of the effect on the fields inside two resonators of a small aperture in the common wall.

621.396.611.4 **3463**

Flat Cavities as Electrical Resonators.—C. G. A. von Lindern & G. de Vries. (*Philips tech. Rev*, May 1946, Vol. 8, No. 5, pp. 149–160.) The characteristic vibrations of Lecher systems short-circuited at one end are first considered. It is then shown that in the case of conical flat cavity resonators, short-circuited round their outer edge, the rotation-symmetrical vibrations correspond exactly to those of the short-circuited Lecher systems. The rotation-symmetrical vibrations of flat resonators of more general forms are discussed and curves are given for the variation of current and voltage with the radius. Resonance resistance and quality factor are calculated; these can be improved by making the cavity resonators thicker than those for which the theory given applies unconditionally. Examples are given of practical, resonators and of their use for h.f. stabilization or as output and input electrodes for short-wave transmitting valves.

621.396.611.4 **3464**

End Plate and Side Wall Currents in Circular Cylinder Cavity Resonator.—J. P. Kinzer & I. G. Wilson. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, pp. 31–79.) Formulae are given for the calculation of the current streamlines and intensity in the walls of a circular cylindrical cavity resonator. Tables are given which permit calculation for many of the lower order modes.

The integration of $\int_0^x [J_l(x)/J_l'(x)]dx$ is discussed and the integral is tabulated for $l = 1$, 2 and 3.

The current distribution for a number of modes is shown by plates and figures.

621.396.611.4 : 621.396.662.3.029.64 **3465**

Cavity Resonators.—M. W. Wheeler. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 60.) Summary of I.R.E. paper. Discussion of their characteristics and use as u.h.f. band-pass filters.

621.396.611.4.029.64 : 621.396.662 **3466**

3 cm Resonant Cavity.—R. R. Reed. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 54–55.) Summary of I.R.E. paper. A transmission-type cavity for use in an automatic frequency-control circuit. The resonant frequency is nearly independent of temperature and humidity effects and may be accurately pretuned. Source and load are coupled to the cavity by 'Kovarglass' windows; temperature compensation is effected by altering the length of the cavity by a flexible diaphragm moved by the differential expansion of copper and invar.

621.396.615 : 621.316.726.078.3 **3467**

Synchronization of Oscillators.—R. D. Huntoon & A. Weiss. (*Bur. Stand. J. Res.*, April 1947, Vol. 38, No 4 pp. 397–410.) An analysis of the behaviour of any self-limiting oscillator when a sinusoidal current or voltage of small but constant magnitude is injected into it. The synchronization band is proportional to the injected voltage. The theory was checked by measurements on a small Hartley oscillator at 11.5 Mc/s. The analysis includes the mutual synchronization of two oscillators. For synchronization measurements the driving oscillator must be more powerful than the test oscillator. Applications of the synchronized oscillator include (*a*) linear voltmeter for small voltages, (*b*) field-intensity meter, (*c*) linear a.m. demodulator for small signals, (*d*) f.m. demodulator, (*e*) f.m. synchronous amplifier limiter.

In these applications microwave generators can be used as well as the more conventional triode oscillators.

621.396.615.14 **3468**

The Excitation of Resonant Circuits by Electron Currents in the Transit-Time Domain.—F. W. Gundlach. (*Rev. sci., Paris*, 1st Jan. 1947, Vol. 85, No. 3264, pp. 19–28.) Translation into French of paper to appear in *Hochfrequenztechnik*. A method is described which gives the magnitude of both the in-phase and quadrature components of the circuit current induced by an electron current through a valve grid. The intensity and velocity of the electron current may vary in any periodic manner with time. The method is applicable to all possible cases and a series of abacs is provided. Application is made to the Barkhausen-Kurz oscillator.

621.396.615.14 **3469**

Band-Switched Exciter.—P. W. J. Gammon. (*Short Wave Mag.*, March 1947, Vol. 5, No. 1, pp. 16–20.) A switched-coil oscillator and frequency-doubler circuit for driving high-powered output stages on frequencies between 1.7 and 28 Mc/s.

621.396.615.142 **3470**

The Principles of a General Theory of the Generation of Electron Oscillations at Ultra High Frequencies.—V. I. Kalinin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 93–102. In Russian.) 'Electron oscillations' are defined as oscillations the excitation of which depends ultimately on the inertia of electrons. A general scheme of the different phases in the excitation of such oscillations is presented in a graphical form (Fig. 1) and using Brüche and Recknagel's conception of 'phase focusing' (2325 of 1938) the foundations are laid of a theory which would not only explain the oscillation mechanism but also answer questions relating to the energy balance in an electron oscillator.

The first two fundamental equations (I and II) cover the kinetic side of the problem and determine respectively the current in the oscillator and the condition necessary for the formation of a focus. Two energy equations (III and IV) determining respectively the power output and efficiency of the oscillator are also derived.

The main factor determining the character of any particular modification of the oscillating system is the distribution and behaviour of potentials in the transformation zone where the velocity-modulated beam is subjected to the action of an electric field with a potential varying in space and time in a known manner. If the electric field is absent and the velocity-modulated beam is moving by inertia, the simplest case corresponding to a two-circuit klystron is obtained. Conclusions reached in studying this case are briefly enumerated and as a further illustration of the proposed theory the operation of an oscillator with a retarding field in the transformation zone is discussed in detail.

621.396.615.17 : 621.396.663 **3471**

On a Standardized Aperiodic Pulse Generator and Its Application to the Statistical Recording and Radiogoniometry of Atmospherics.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 9th June 1947, Vol. 224, No. 23, pp. 1624–1626.) Apparatus similar in principle to that used by R. Bureau for atmospheric recording, but including a standardized variable inductive coupling between the capacitor discharge circuit and either the aerial or the input circuit of the receiver-recorder. Some circuit details are given and the methods of use and standardization are briefly described.

621.396.621.54 **3472**

The Inversion of the Autodyne Principle.—F. C. Saic. (*Elektrotech. u. Maschinenb.*, Jan./Feb. 1947, Vol. 64, Nos. 1/2, pp. 16–24.) A new type of heterodyne arrangement is described in which the oscillator frequency is fixed and the i.f. variable. Numerous advantages are claimed. A scheme is given for an all-wave receiver incorporating the new principle and giving an appreciable increase in output power.

621.396.622.71 **3473**

The Ratio Detector.—Seeley & Avins. (*See* 3643.)

621.396.645 **3474**

Theory of Grounded Grid Amplifiers.—A. van der Ziel. (*Philips Res. Rep.*, Nov. 1946, Vol. 1, No. 5, pp. 381–399.) In part 1 a survey of the existing triode theory at u.h.f. is given. Neglecting lead effects, the four characteristic impedances of a grounded-grid triode at u.h.f. can be described by the 'cold' valve capacitances, the amplification factor μ and the transconductances S_1 and S_2 in the cathode-grid lead and grid-anode lead respectively (the moduli and the phase angles of these transconductances can be measured). Shot effect in triode valves can be completely described by assuming two mutually dependent fluctuating currents i_1 and i_2 to be flowing in the cathode-grid lead and in the grid-anode lead respectively; at u.h.f. i_2 is delayed in phase with respect to i_1 (the introduction of these mutually dependent fluctuating currents is a direct consequence of the Fourier analysis of the shot effect). It is shown that the introduction of the 'equivalent noise resistance' of the valve may cause serious errors in the calculation of the signal/noise ratio.

In part 2 this theory is applied to grounded-grid amplifiers. The input resistance R_1 of the valve when the output is short-circuited and the output resistance R_2 of the valve when the input is short-circuited, are of special importance in this case. Denoting the transformed aerial resistance by R'_1 and the transformed input resistance of the next stage by R'_2, the power gain g is calculated as a function of R'_1/R_1 and R'_2/R_2. It is shown that the internal feedback of the valve makes it impossible to match at the same time the aerial to the input of the amplifier and its output to the input of the next stage. The best results are obtained by using a high value of R'_1/R_1 (loose aerial coupling) and matching the output of the amplifier to the next stage. The theoretical gain limit is $(\mu + 1)$; values between $0.5\ (\mu + 1)$ and $0.8\ (\mu + 1)$ may easily be obtained. For wide-band amplifiers $R'_1/R_1 = 1$ for maximum gain, whereas it is shown that a wide anode-grid spacing will give a higher gain. It is shown that electronic transit times cannot account for the drop in power gain at u.h.f.; this drop must be due to the impedance of the electrode leads. At u.h.f. instability may occur; a stability condition is given, from which it can be seen that careful shielding and narrow electrode spacings result in a better stability of the amplifier. Finally the signal/noise ratio of the grounded-grid amplifier is calculated and it is shown that the grounded-grid amplifier contributes only slightly to the noise, especially for large values of R'_1/R_1. This result is verified experimentally.

621.395.645 **3475**

Non-Stationary Processes in Tuned and Band-Pass Amplifiers.—A. N. Shchukin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 37–48. In Russian.) A mathematical investigation of the processes taking place in amplifiers when a constant or an alternating e.m.f. is suddenly applied.

621.396.645 **3476**

A Note on a Paper by Faust and Beck.—W. M. Stone. (*J. appl. Phys.*, April 1947, Vol. 18, No. 4, pp. 414–416.) "An infinite sum transformation is defined and applied to a system of linear difference equations discussed by Faust & Beck in their paper on single tuned amplifiers [677 of March]. Some transforms of the more common functions are given and points of superiority of the transform method over the classical methods of solution of difference equations are emphasized."

621.396.645 : 534.78 **3477**

The Theory and Design of Speech Clipping Circuits.—M. H. Dean. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 62–65..119.) The action of a compressor in preventing overmodulation of a.m. transmitters is described, and is shown to be less effective than might be expected. Clipping speech peaks squarely at a pre-determined level, and inserting a low-pass filter to eliminate any harmonics caused thereby, is considered better, and the design of a clipper suitable for good commercial speech transmission is given.

621.396.645.029.3 **3478**

A Portable Two Channel Amplifier and Ink Recorder.—W. Grey Walter & A. A. Brooks. (*Electronic Engng*, July 1947, Vol. 19, No. 233, pp. 221–226.)

621.396.645.029.62 **3479**

Broad Band Amplifiers.—A. M. Levine & M. G. Hollabaugh. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 58.) Summary of I.R.E. paper. Calculations for input damping and instability due to feedback are outlined. Calculated and measured values are given for various valve types throughout the 30–300-Mc/s range. Measurements taken on actual amplifiers are displayed graphically.

621.396.645.029.63 **3480**

550 Megacycle Amplifier.—R. O. Petrich. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 59.) Summary of I.R.E. paper. A gain of 10 db for each of five stages has been obtained for a 20-Mc/s bandwidth, using a lighthouse triode in a grounded-grid amplifier circuit.

621.396.645.029.64 : 621.396.615.142.2 **3481**

On U.H.F. Amplification and on the Resonance Method for suppressing Noise in a Klystron.—Yu. A. Katsman. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 23–28. In Russian.) The use of klystrons at the input stage of a radio receiver at frequencies greatly exceeding 600 Mc/s is limited by the high level of valve noise. To overcome this difficulty it is suggested that a resonant oscillatory circuit absorbing the noise energy should be connected between the cathode and the input electrodes of the valve.

621.396.645.35 : 621.317.71/.72 **3482**

Stabilized D.C. Amplifier with High Sensitivity.—H. S. Anker. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 138, 140.) Designed to measure very small currents or voltages from a high-impedance source.

621.396.645.37 **3483**

Feed-Back Amplifiers.—J. A. Rado, A. M. Levine & M. G. Hollabaugh. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 55.) Summary of I.R.E. paper. Analysis of the generalized feedback amplifier shows that it can be regarded as a ladder network with negative conductance shunt arms. Mathematical analysis shows that these amplifiers have a gain-bandwidth capacity equal to that of an ideal amplifier. In actual amplifiers the ideal has been approached very closely.

621.396.645.37.029.3 **3484**

A Stable Selective Audio Amplifier.—J. M. Sturtevant. (*Rev. sci. Instrum.*, Feb. 1947, Vol. 18, No. 2, pp. 124–127.) A narrow-band amplifier using both frequency-dependent and independent degeneration to secure stability and linearity.

621.396.662 **3485**

Electronic Attenuators.—F. W. Smith, Jr, & M. C. Thienpont. (*Communications*, May 1947, Vol. 27, No. 5, pp. 20–22.) Continuously variable attenuation over a wide frequency range is achieved by varying the cathode load of a cathode follower. The influence of various factors on design is discussed and a typical attenuator described.

621.396.662.3.029.3 **3486**

Tuned A.F. Filters : Part 1.—H. E. Styles. (*Wireless World*, July 1947, Vol. 53, No. 7, pp. 242–244.) General considerations and design formulae.

621.396.69 + 621.317.7 + 621.38 **3487**

The Physical Society's Exhibition.—(*See* 3581.)

621.396.69 : 621.315.3 **3488**

Stamped Wiring.—W. MacD. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 82–85.) Basically, a series of vertical and horizontal conducting strips, separated by a thin sheet of insulator, with interconnection by eyelets or pins.

621.397.335 **3489**

New Techniques in Synchronizing-Signal Generators.—E. Schoenfeld, W. Brown & W. Milwitt. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 237–250.) The pulse edges are established by means of a terminated artificial transmission line carrying 31.5-kc/s trigger impulses and their number during each framing interval is determined by an electronic counter. The locked-in relationship between line and field scanning frequencies makes use of the cascade-binary type of frequency divider.

621.38/.39].01 **3490**

Fundamentals of Industrial Electronic Circuits. [Book Review]—W. Richter. McGraw-Hill Book Publishing Co., London and New York, 1947, 569 pp., 22s. 6d and $4.50. (*Elect. Rev., Lond.*, 6th June 1947, Vol. 140, No. 3628, p. 930 : *Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, p. 707.) The interest of the book is not confined to industrial electronics. The explanations of fundamentals and valves are so good that those mainly interested in radio would do well to study it. Intended as a text of intermediate standard for use in evening classes.

GENERAL PHYSICS

535.13 : 512.831 **3491**

On the Matrix Form of Maxwell's Equations.—J. Baudot. (*C. R. Acad. Sci., Paris*, 9th June 1947, Vol. 224, No. 23, pp. 1622–1624.) See also 2475 of August.

535.215 : 621.383.4 **3492**

Lead Sulphide Photoconductive Cells.—Sosnowski, Starkiewicz & Simpson. (*See* 3709.)

536.21 : 517.942.9 **3493**

Heat Conduction in Elliptical Cylinder and an Analogous Electromagnetic Problem.—N. W. McLachlan. (*Phil. Mag.*, March 1946, Vol. 37, No. 266, p. 216.) Correction to 3570 of 1946.

536.422 **3494**

The Escape of Molecules from a Plane Surface into a Still Atmosphere.—K. J. Brookfield, H. D. N. Fitzpatrick, J. F. Jackson, J. B. Matthews & E. A. Moelwyn-Hughes. (*Proc. roy. Soc. A*, 17th June 1947, Vol. 190, No. 1020, pp. 59–67.)

536.483 **3495**

A Helium Cryostat.—S. C. Collins. (*Rev. sci. Instrum.*, March 1947, Vol. 18, No. 3, pp. 157–167.) For temperatures down to 2°K. Three types of expansion device are described.

537.122 : 538.3 **3496**

The Electron and Electromagnetic Theory.—G. Darrieus. (*Bull. Soc. franç. Élect.*, May 1947, Vol. 7, No. 69, pp. 249–264.) Certain difficulties of the classical theory are discussed and an outline is given of a modified Born-Infeld nonlinear theory.

537.228.1 : 512.9 **3497**

First and Second Order Equations for Piezoelectric Crystals expressed in Tensor Form.—W. P. Mason. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, pp. 80–138.) The phenomena occurring on application of electric fields, stresses and temperature changes are examined. The nine first order effects are considered for the 32 types of crystal and measurement methods are discussed. Second order effects dealt with are :—elastic constants dependent on the applied stress and electric displacement, the electrostrictive effect, piezoelectric constants dependent on the applied stress, and the piezo-optical and electro-optical effects. These second order equations may be used to examine the phenomena occurring in ferroelectric type crystals, and are applied to the case of Rochelle salt.

537.32 **3498**

Thermoelectric Properties of Conductors : Part 1.—L. Gurevich. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 6, pp. 477–488.) A new possible mechanism for thermoelectric e.m.f. is the carrying of electrons by the phonon current created by the temperature gradient. In a certain temperature range this e.m.f. may greatly exceed that to be expected from the usual theory, and observed anomalies may be due to the transition from one mechanism to another.

537.525.5 + 621.314.65 **3499**

On the Mechanism of Dielectric Ignition and Resistance Ignition in Mercury Arc Rectifiers. [Thesis]—Warmoltz. (*See* 3670.)

537.527 **3500**

Similarity of High-Pressure Discharges of the Convection-Stabilized Type.—W. Elenbaas. (*Philips Res. Rep.*, Nov. 1946, Vol. 1, No. 5, pp. 339–359.) Similarity conditions are deduced for discharges in free air, or in tubes so wide that the walls have no effect. Pressures considered are so high that energy loss by radiation, dissociation and diffusion is negligible. Similarity conditions for discharges in various gases, discharges stabilized by forced convection and discharges in closed tubes filled with various gases are also considered.

538 **3501**

Magnetism.—R. M. Bozorth. (*Rev. mod. Phys.*, Jan. 1947, Vol. 19, No. 1, pp. 29–86.) A general descriptive account of the whole subject, taken from the American edition of the Encyclopaedia Britannica. Magnetic theory is treated historically down to the modern 'electron-spin' theory. A section is devoted to the measurement of magnetic quantities and references are given to modern papers on this subject. A bibliography of textbooks is appended.

538.532 : 621.316.974 : 621.318.4 **3502**

The Field of a Coil between Two Parallel Metal Sheets.—E. B. Moullin. (*J. Instn elect. Engrs*, Part I, March 1947, Vol. 94, No. 75, p. 158.) Summary of 2077 of July.

538.56 **3503**

Relative Directions of the Electric and Magnetic Vectors in Electromagnetic Waves *in Vacuo*.—N. S. Japolsky. (*Nature, Lond.*, 26th April & 14th June 1947, Vol. 159, Nos. 4043 & 4050, pp. 580 & 817.) In general the electric vector E and the magnetic vector B will not be perpendicular for electromagnetic waves in vacuo. They are perpendicular in the special cases of (*a*) non-rotating vectors, (*b*) circularly polarized plane waves, and (*c*) spherical or cylindrical waves.

538.56 : 535.13 **3504**

The Reflection of an Electromagnetic Plane Wave by an Infinite Set of Plates : Part 2.—A. E. Heins & J. F. Carlson. (*Quart. appl. Math.*, April 1947, Vol. 5, No. 1, pp. 82–88.) In part 1 (2756 of September) the case was treated in which only one component of the electric field was excited, the incident electric field being parallel to the edges of the plates. Fourier transform technique is again used when the excitation is by a plane wave which has only a single component of the magnetic field parallel to the edges of the plates. In this case it is found that the reflection and transmission coefficients are independent of the wavelength and depend only on the angle of stagger of the plates and the angle of incidence of the waves.

538.566 **3505**

[One-Dimensional] **Propagation of a Perturbation, of Narrow Frequency Range, in a Non-Absorbing Dispersive Medium.**—A. Blanc-Lapierre & P. Lapostolle. (*Rev. sci., Paris*, 1st/15th Dec. 1946, Vol. 84, Nos. 3262/3263, pp. 579–595.) The type of perturbation considered is that of filtered background noise or quasi-monochromatic light. The harmonic analysis of such perturbations leads to a representation analogous to a Fourier integral. The notions of phase velocity and group velocity are analysed and their limits of validity are given as functions of the width of spectrum considered and of the dispersive properties of the medium in the neighbourhood of the mean frequency. The results of the analysis are summarized and discussed.

538.567.2 **3506**

The Biased Ideal Rectifier.—W. R. Bennett. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, pp. 139–169.) Methods of solution and results are given for the frequency response of devices with sharply defined transitions between the conducting and non-conducting portions of their characteristics.

538.569.4.029.64 : 546.171.1 **3507**

The Inversion Spectrum of Ammonia at Centimetre Wavelengths.—B. Bleaney & R. P. Penrose. (*Proc. roy. Soc. A*, 1st May 1947, Vol. 189, No. 1018, pp. 358–371.) Measurement technique and results for wavelengths between 1.1 and 1.6 cm. 29 lines have been identified, each corresponding to a different rotational quantum state. An accurate formula is given for the wave numbers of these lines. See also 2622 of 1946 and 3096 of October (Strandberg et al.).

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.72 : 621.396.822.029.62 **3508**

Solar Radio Noise : Part 1.—E. V. Appleton & J. S. Hey. (*Phil. Mag.*, Feb. 1946, Vol. 37, No. 265, pp. 73–84.) An account of experiments carried out during a period of sunspot activity. Ground-level measurements of the noise spectrum at metre wavelengths are described ; the shape of the spectral curve at the longer wavelengths is deformed by ionospheric influences. Enhancement of the noise has been observed to occur simultaneously with solar flares and short-wave radio fade-outs. See also 402 of February (Appleton) and back references.

523.746 : 538.12 **3509**

The Growth and Decay of the Sunspot Magnetic Field.—T. G. Cowling. (*Mon. Not. R. astr. Soc.*, 1946, Vol. 106, No. 3, pp. 218–224.) The rapid growth and decay, a matter of days, is thought to be due to convection and an initial magnetic field, otherwise the time taken would be about 300 years.

523.746 " 1947.03/.04 " **3510**

Recent Solar Activity.—(*Nature, Lond.*, 19th April 1947, Vol. 159, No. 4042, p. 549.) Report on the return of the sunspot group mentioned in

2760 of September. In April it had a peak area of 5 400 millionths of the sun's hemisphere, and there were no associated magnetic storms. See also 3107 of October.

523.854 : [621.396.822.029.58/.6 **3511**

Interpretation of Radio Radiation from the Milky Way.—C. H. Townes. (*Astrophys. J.*, March 1947, Vol. 105, No. 2, pp. 235–240.) A discussion of the emission of radiation by ionized interstellar gas. Measurements between 30 000 and 9.5 Mc/s are analysed and compared with theory. The radiation is explicable on the basis of an electron gas density of about 1 electron per cm³ and a temperature of 100 000°–200 000° K, which is much higher than that indicated previously. See also 402 of February and 3598 and 3599 of 1946.

537.591 **3512**

Further Cosmic-Ray Experiments above the Atmosphere.—S. E. Golian & E. H. Krause. (*Phys. Rev.*, 15th June 1947, Vol. 71, No. 12, pp. 918–919.)

537.591 **3513**

Slow Cosmic Ray Mesons at Sea-Level.—G. R. Evans & T. C. Griffiths. (*Nature, Lond.*, 28th June 1947, Vol. 159, No. 4052, pp. 879–880.)

537.591 **3514**

Recent Research in Meson Theory.—G. Wentzel. (*Rev. mod. Phys.*, Jan. 1947, Vol. 19, No. 1, pp. 1–18.)

537.591 **3515**

The Production of Nucleons by the Cosmic Radiation.—S. A. Korff & B. Hamermesh. (*Phys. Rev.*, 15th June 1947, Vol. 71, No. 12, pp. 842–845.)

551.510.53 **3516**

The Temperature of the Upper Atmosphere.—R. Penndorf. (*Bull. Amer. met. Soc.*, June 1946, Vol. 27, No. 6, pp. 331–342.) Translation of paper in *Met. Z.*, Jan. 1941, Vol. 58, No. 1, pp. 1–10. Summary noted in 3492 of 1942. A critical review of work published up to 1940. It is concluded that the probable thermal structure for latitudes 45°–55° may be represented approximately by the following points: 10 km, 220° K; 35 km, 230° K; 50 km, 320° K; 80 km, 200° K; 100 km, 330°–370° K; 230 km, 430°–830° K. Data for high latitudes are also discussed briefly.

551.510.53 **3517**

The Constitution of the Stratosphere.—R. Penndorf. (*Bull. Amer. met. Soc.*, June 1946, Vol. 27, No. 6, pp. 343–345.) Translation of paper in *Met. Z.*, 1941, Vol. 58, No. 3, pp. 103–105. Summary noted in 3492 of 1942. The pressure/height relation used is $\log_e(p_2/p_1) = -A(h_2 - h_1)/T$. Assuming the values of T as a function of height given in 3516 above, pressure is calculated in 1-km steps up to 100 km where the value agrees with that given by Martyn & Pulley (2073 of 1936) based on ionospheric data. The values of p are used to derive other parameters as a function of height and the results are tabulated for 10 km intervals up to 100 km.

551.510.535 **3518**

Ionospheric Clouds.—H. G. Wells. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 53–54.) Summary of I.R.E. paper. A description of a motion-picture pulse recording equipment.

551.510.535 : 621.396.11 **3519**

Radio Investigation of the Ionosphere.—C. J. Bakker. (*Philips tech. Rev.*, April 1946, Vol. 8, No. 4, pp. 111–120.) A general survey of the physical constitution and properties of the ionosphere and their bearing on radio communication.

551.510.535 : 621.396.11 **3520**

The Role of the Ionosphere in the Propagation of Radio Waves.—R. Jouaust. (*Bull. Soc. franç. Élect.*, May 1947, Vol. 7, No. 69, pp. 265–270.) Discussion on 1447 of May.

551.510.535 : 621.396.11 **3521**

Radiation Angle Variations from Ionosphere Measurements.—Hallborg & Goldman. (*See* 3625.)

551.547+551.524.7 **3522**

Pressure and Temperature of the Atmosphere to 120 km.—N. Best, R. Havens & H. LaGow. (*Phys. Rev.*, 15th June 1947, Vol. 71, No. 12, pp. 915–916.) Results of measurements made using a V-2 rocket and discussion of their accuracy.

LOCATION AND AIDS TO NAVIGATION

621.396.663 : 621.396.615.17 **3523**

On a Standardized Aperiodic Pulse Generator and Its Application to the Statistical Recording and Radiogoniometry of Atmospherics.—Carbenay. (*See* 3471.)

621.396.93 : 519.2 **3524**

A Problem on the Summation of Simple Harmonic Functions of the Same Amplitude and Frequency but of Random Phase.—Horner. (*See* 3566.)

621.396.93 : 551.594.6 **3525**

The Location of Thunderstorms by Radio Direction-Finding.—F. Adcock & C. Clarke. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 237.) Summary of 2779 of September.

621.396.93 : 621.396.677 **3526**

The Development and Study of a Practical Spaced-Loop Radio Direction-Finder for High Frequencies.—W. Ross. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 235.) Summary of 2780 of September.

621.396.93 : 621.396.677 **3527**

The Use of Earth Mats to reduce the Polarization Error of U-Type Adcock Direction-Finders.—R. L. Smith-Rose & W. Ross. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 234.) Summary of 2781 of September.

621.396.93 : 621.396.677.029.58 **3528**

Site and Path Errors in Short-Wave Direction-Finding.—W. Ross. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 235.) Summary of 2782 of September.

621.396.93 : 621.396.677.029.62 **3529**

An Experimental Spaced-Loop Direction-Finder for Very High Frequencies.—F. Horner. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 233.) Summary of 2783 of September.

621.396.93 : 621.396.677.029.63 **3530**

Some Experiments on Conducting Screens for a U-Type Spaced-Aerial Radio Direction-Finder in the Frequency Range 600-1 200 Mc/s.—R. R. Pearce. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 236.) Summary of 2784 of September.

621.396.932 **3531**

Radar for Merchant Marine Service.—F. E. Spaulding, Jr. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 312–330.) "Discusses the technical features of a new 3-centimeter merchant marine radar equipment. Factors relating to the basic design are treated and operation of the various circuits is explained by reference to functional block diagrams. The physical form of the apparatus is shown and plan-position-indicator (PPI) photographs are included to illustrate the navigational data furnished by this instrument. Specifications defining the performance characteristics are also included." See also 2194 of 1946 (Byrnes).

621.396.933 **3532**

P.I.C.A.O. Report on Navigational Aids. [Book Notice]—Obtainable from E. M. Lewis, North Atlantic Regional Office, 7 Fitzwilliam Place, Dublin, 3s. 9d. (*Engineer, Lond.*, 2nd May 1947, Vol. 183, No. 4762, p. 369.) Final report covering the first session in Montreal.

621.396.933.2 **3533**

The Theory and Application of the Radar Beacon.—R. D. Hultgren & L. B. Hallman, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 716–730.) The functions of the various components of a typical beacon and its applications.

621.396.933.2 : 621.396.615.141.2 **3534**

Stabilized Magnetron for Beacon Service : Part 1 — Development of Unstabilized Tube.—Donal, Cuccia & Brown. (*See* 3736.)

621.396.933.2 : 621.396.615.141.2 **3535**

Stabilized Magnetron for Beacon Service : Part 2 — Engineering of Tube and Stabilizer.—Vogel & Dodds. (*See* 3737.)

621.396.96 : 621.317.79 **3536**

Echo Boxes for Radar Testing.—Marshall. (*See* 3592.)

621.396.96 : 623.827 **3537**

Electronics in Submarine Warfare.—C. A. Lockwood. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 712–715.)

621.396.96(52) **3538**

Short Survey of Japanese Radar : Part 1.—R. I. Wilkinson. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, p. 215.) Summary of part 1 of 424 of February.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **3539**

Thermal and X-Ray Analyses of Some Common Phosphors.—R. Nagy & Chung Kwai Lui. (*J. opt. Soc. Amer.*, Jan. 1947, Vol. 37, No. 1, pp. 37–41.) The structural changes which occur in the formation of phosphors are explained and the correct firing temperatures for maximum fluorescence determined.

535.61-15 : 666.112.3 : 535.34 **3540**

Infrared Absorption Spectra of Some Experimental Glasses containing Rare Earth and Other Oxides.—R. Stair & C. A. Faick. (*Bur. Stand. J. Res.*, Jan. 1947, Vol. 38, No. 1, pp. 95–101.) Transmission data for soda lime glasses from 0.7 to 4.5 μ.

535.61-15/-2 : 679.5 **3541**

Plastic Filters for the Visible and Near Infra-Red Regions.—J. H. Shenk, E. S. Hodge, R. J. Morris, E. E. Pickett & W. R. Brode. (*J. opt. Soc. Amer.*, Oct. 1946, Vol. 36, No. 10, pp. 569–575.) Discussion of the combination of dyes and plastics to give filters capable of resisting heat, intense light, and weather effects, and possessing specified transmission characteristics.

538.21 : 669.14-41 **3542**

Medium-Frequency Magnetization of Sheet Steel.—R. Pohl. (*J. Instn elect. Engrs*, Part II, April 1947, Vol. 94, No. 38, pp. 118–123.) Discusses the interdependence of hysteresis, eddy currents and magnetic utilization and gives simple expressions and curves for eddy-current loss, apparent flux and utilization factor. Summary *ibid.*, Part I, June 1947, Vol. 94, No. 78, p. 278. For earlier work see 2047 of 1945.

620.197 **3543**

Protective Finishing of Electrical Equipment.—(*Engineering, Lond.*, 25th April 1947, Vol. 163, No. 4239, p. 330.) Summary of I.E.E. paper by F. Widnall & R. Newbound. A general survey covering self-protective materials, electrolytic and chemical finishing, paint spraying, vitreous enamelling, metal spraying and test methods. For another account see *Elect. Times*, 6th March 1947, Vol. 111, No. 2887, p. 246.

621.314.63 **3544**

Remarks on the Operation and Construction of Barrier Layer Rectifiers.—M. Leblanc. (*Bull. Soc. franç. Élect.*, April 1947, Vol. 7, No. 68, pp. 202–208.) Discussion on 1468 of May.

621.314.63 **3545**

Applications of Dry Rectifiers.—J. M. Girard. (*Bull. Soc. franç. Élect.*, April 1947, Vol. 7, No. 68, pp. 202–208.) Discussion on 1469 of May.

621.315.59+537.311.33 **3546**

Semiconductors and Their Applications.—A. F. Ioffe. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 3–14. In Russian.) The work in progress at the Physico-Technical Institute of the Academy is surveyed under the following headings : (*a*) The determination of the number of the conductivity electrons and of their mobility ; experimental curves for various types of semiconductors are shown. (*b*) Electrical conductivity in strong electric fields : deviations from Ohm's law are discussed. (*c*) The mechanism of conductivity : factors determining the direction of the current passed by a semiconductor are examined. (*d*) Boundary layers : the penetration into semiconductors of the field set up by the contact potential difference is considered. (*e*) Photoelectric phenomena : spectral sensitivity characteristics are plotted for various semiconductors. (*f*) Applications of semiconductors : particulars of the Ag_2S and Tl_2S photocells of Soviet manufacture are given in Table 2.

621.315.61.011.5 : 546.431.823 : 537.228.1 **3547**

Dielectric and Piezoelectric Properties of Barium Titanate.—S. Roberts. (*Phys. Rev.*, 15th June 1947, Vol. 71, No. 12, pp. 890–895.) Description and discussion of measurements of dielectric constant and loss at biasing field strengths from

0 to 5 MV/m, at temperatures from −50°C to +135°C and at frequencies from 0.1 to 25 Mc/s. The transverse and longitudinal piezoelectric effects have been measured directly.

621.315.611.011.5 + 537.226.3 **3548**

The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Solid Dielectrics : Part 3.—M. Gevers. (*Philips Res. Rep.*, Aug. 1946, Vol. 1, No. 4, pp. 298–313.) A new theory is presented which explains why, for most of the commercial dielectrics, the ratio between the temperature coefficient (T.C.) of the dielectric constant and the power factor $\tan\delta$ has a value of about 0.6. Hence the value of the T.C. can be predicted from measurements of $\tan\delta$ at two different frequencies and two temperatures. For a mixture of dielectrics a simple linear relation is found to exist between its T.C. and those of the components. Thus a mixture of 90% CeO_2 (T.C. $+100 \times 10^{-6}$) and 10% TiO_2 (T.C. -880×10^{-6}) has a T.C. approximately zero. The linear relation does not apply to the power factors of the components of a composite dielectric and no general law relating T.C. and $\tan\delta$ can be given for mixtures, particularly if some of the components have a positive and others a negative T.C. For part 4 see 3572 below.

621.315.611.011.5 + 537.226.3 **3549**

The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Solid Dielectrics : Part 4.—Gevers. (*See* 3572.)

621.315.612.2 **3550**

Alkaline Earth Porcelains possessing Low Dielectric Loss.—M. D. Rigterink & R. O. Grisdale. (*J. Amer. ceram. Soc.*, 1st March 1947, Vol. 30, No. 3, pp. 78–81.) Porcelain bases for deposited carbon resistors, prepared from mixtures of clay, flint and synthetic fluxes consisting of clay calcined with at least three alkaline earth oxides. These white porcelains have excellent dielectric properties and low coefficients of thermal expansion.

621.315.612.4.011.5 **3551**

Properties of Barium-Strontium Titanate Dielectrics.—E. N. Bunting, G. R. Shelton & A. S. Creamer. (*Bur. Stand. J. Res.*, March 1947, Vol. 38, No. 3, pp. 337–349 ; *J. Amer. ceram. Soc.*, 1st April 1947, Vol. 30, No. 4, pp. 114–125.) Results are given for various properties, including dielectric constant and power factor reciprocal for frequencies of 50–20 000 kc/s, together with some measurements at 3 000 Mc/s.

621.316.89 + 621.315.59 **3552**

Properties and Uses of Thermistors — Thermally Sensitive Resistors.—J. A. Becker, C. B. Green & G. L. Pearson. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, pp. 170–212.) Reprint of 765 of March.

621.318.2 : 621.775.7 **3553**

Sintered Permanent Magnets.—S. J. Garvin. (*Engineering, Lond.*, 30th May & 6th June 1947, Vol. 163, Nos. 4244 & 4245, pp. 445–446 & 465–467.) A review of the development of sintering and a detailed account of recent methods for producing accurately shaped magnets of alnico or alcomax. Such methods involve the use of a 'master alloy' of 48% Fe, 52% Al, which has a wetting point about 100°C below the sintering temperature. This alloy is brittle and can be crushed readily to a fine powder. It is also much less prone to oxidation than pure Al, so that commercial hydrogen can be used as the atmosphere during the sintering process.

621.318.22 : 669.144.25 **3554**

Vicalloy — A Workable Alloy for Permanent Magnets.—G.W.O.H. (*Wireless Engr*, July 1947, Vol. 24, No. 286, p. 192.) Editorial comment on a Bell Telephone System monograph by E. A. Nesbitt. Vicalloy is a new alloy of Fe, Co and Va, which can be rolled and drawn and has been used as a tape 0.05 inch × 0.002 inch for speech recording in the Western Electric mirrorphone.

621.318.323.2.042.15 **3555**

Permeability of Dust Cores.—V. E. Legg. (*Wireless Engr*, July 1947, Vol. 24, No. 286, pp. 218–219.) Comment on 35 of January. The value of an empirical formula for the permeability of molybdenum permalloy cores given in 4424 of 1940 (Legg & Given) is discussed. An empirical treatment is stated to be more profitable than a mathematical analysis of the magnetic behaviour of such cores, as the shape and size of the magnetic particles and their relative dispositions in the insulating material are not simple and depend on the grain structure of the permalloy as originally cast and on its subsequent treatment. See also 1692 and 1693 of June and 2816 of September.

666.2 : 621.327.3 **3556**

Ultraviolet-Transmitting Glasses for Mercury-Vapor Lamps.—M. E. Nordberg. (*J. Amer. ceram. Soc.*, 1st June 1947, Vol. 30, No. 6, pp. 174–179.) The ultraviolet transmitting properties of Vycor glasses No. 791 and No. 7911 are compared with those of certain other glasses and fused silica. Transmission loss with age is much less than with other glasses.

678 + 546.26] : 621.317.331 **3557**

Electrical Conductivity of GR-S and Natural Rubber Stocks loaded with Shawinigan and R-40 Blacks.—P. E. Wack, R. L. Anthony & E. Guth. (*J. appl. Phys.*, May 1947, Vol. 18, No. 5, pp. 456–469.)

679.5 **3558**

A Plastics Primer for Engineers.—K. Rose. (*Materials & Methods*, April 1947, Vol. 25, No. 4, pp. 119–138.) Description and characteristics are given for thermosetting resins of the phenolic, amino-formaldehyde, aniline-formaldehyde and allyl ester groups and the effects of various fillers upon their properties are discussed. Thermoplastic groups include cellulosics, vinyls, acrylics, polyamides, polystyrenes, polyethylene, polytetrafluorethylene, caseins and silicones. The trade names by which the principal plastics are known in the U.S.A. are tabulated.

679.5 : 621.315.616 **3559**

Teflon — An Improved Plastic for R.F. Use.—W. S. Penn. (*Electronic Engng*, July 1947, Vol. 19, No. 233, p. 220.) Electrical, mechanical and dielectric properties of polytetrafluorethylene (Teflon) and polythene are compared. See also 1121 of April and 3169 of October (Johnson).

MATHEMATICS

513.732.6 : 621.396.615.141.2 **3560**

A Flux Plotting Method for obtaining Fields satisfying Maxwell's Equations, with Applications to the Magnetron.—P. D. Crout. (*J. appl. Phys.*, April 1947, Vol. 18, No. 4, pp. 348–355.) Flux plotting methods previously applied to fields satisfying Laplace's and Poisson's equations are here extended to fields satisfying Maxwell's equations. The method is applied to the hole-and-slot type of magnetron operating in its main mode, and to the vane type of magnetron. For previous work see Radiation Laboratory Report 1047.

517.512.2 : 621.396.67 **3561**

Fourier Transforms in Aerial Theory : Part 2.—J. F. Ramsay. (*Marconi Rev.*, Jan./March 1947, Vol. 10, No. 84, pp. 17–22.) Graphs of the Fourier sine transforms of a square wave, a saw-tooth wave, a sine wave and a sine squared wave are given. For part 1 see 2680 of September.

518.5 **3562**

An Electrical Network for the Solution of Secular Equations.—R. H. Hughes & E. B. Wilson, Jr. (*Rev. sci. Instrum.*, Feb. 1947, Vol. 18, No. 2, pp. 103–108.) A network of suitable coils and capacitors is assembled whose resonance equation is identical with the secular determinant. For determining the latent roots of a real symmetric matrix of n rows and columns, the network has n junctions which are interconnected by reactive admittances and grounded by equal variable admittances which represent the unknown in the equation. The values of the variable admittances corresponding to maxima of the voltages of the junctions with respect to ground give the desired roots. Usually an accuracy better than 1% is obtained, for $n \leqslant 6$.

518.5 **3563**

Electrical Analogue Computing : Parts 1 & 2.—D. J. Mynall. (*Electronic Engng*, June & July 1947, Vol. 19, Nos. 232 & 233, pp. 178–180 & 214–216.) The fundamental circuits used for electro-mechanical addition, multiplication, division, differentiation and integration are described. To be continued.

518.5 : 621.385 **3564**

Electrostatic Storage.—Rajachman. (*See* 3712.)

518.61 **3565**

Some Improvements in the Use of Relaxation Methods for the Solution of Ordinary and Partial Differential Equations.—L. Fox. (*Proc. roy. Soc. A*, 17th June 1947, Vol. 190, No. 1020, pp. 31–59.) The standard use of relaxation methods is extended by the inclusion of terms usually neglected in the finite difference equations involved. Eight examples of the method are given, illustrating the high accuracy obtainable with reduced labour.

519.2 : 621.396.93 **3566**

A Problem on the Summation of Simple Harmonic Functions of the Same Amplitude and Frequency but of Random Phase.—F. Horner. (*Phil. Mag.*, March 1946, Vol. 37, No. 266, pp. 145–162.) The problem treated is the determination of the probability $P_n(s)$ that the amplitude of an arbitrarily chosen component of the resultant shall lie between the limits s and $s + ds$. Curves of $P_n(s)$ are given as functions of s for $n = 1, 2, 3$ and 7 where n is the number of harmonic functions involved in the summation. For large values of n, the distribution is of Gaussian form, and it seems likely that the lowest value of n for which the Gaussian curve gives a reasonably good fit is 5. The root mean square values of s are the same for the true and normal distributions for all values of n.

MEASUREMENTS AND TEST GEAR

531.76 : 621.317.755 **3567**

Precision Device for Measurement of Pulse Width and Pulse Slope.—H. L. Morrison. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 276–288.) Direct measurement in microseconds for pulses having the same repetition rate.

531.761 : 621.317.39 **3568**

An Electronic Millisecond Timer.—S. S. West & L. C. Bentley. (*Electronic Engng*, July 1947, Vol. 19, No. 233, pp. 207–210.) The circuit comprises an electronic trigger arrangement, which can be operated by a photocell or from an external source. It will measure short time intervals in the range 0.5–100 ms with an accuracy of ± 2 %. The accuracy depends almost entirely on the stability of a standard capacitor and on the calibrating resistance.

531.765 : 621.317.755 **3569**

Spiral Chronograph for Measurement of Single Millisecond Time Intervals with Microsecond Accuracy.—R. J. Emrich. (*Rev. sci. Instrum.*, March 1947, Vol. 18, No. 3, pp. 150–157.) The spiral timebase is controlled by a crystal ; the c.r.t. beam is held off in the steady state and is switched on by the pulse marking the beginning of the time interval to be measured. The beam brilliance is modulated to provide 5-μs markers and is turned off by the pulse marking the end of the required time interval, an Eccles-Jordan trigger circuit being used. The screen is of long persistence, the trace being measured directly, or photographed as a 'still' record. A pulse sharpening circuit is used to eliminate uncertainty as to the exact time of operation of the on-off trigger.

538.569.4.029.64 : 546.171.1 **3570**

The Inversion Spectrum of Ammonia at Centimetre Wavelengths.—Bleaney & Penrose. (*See* 3507.)

621.3.012.3 **3571**

Microwave Impedance-Plotting Device.—W. Altar & J. W. Coltman. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 734–737.) The device is used in conjunction with a Smith Impedance Chart (1372 of 1939) and computes the angular position of the load point directly from the observed data.

621.315.611.011.5+537.226.3 **3572**

The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Solid Dielectrics : Part 4.—M. Gevers. (*Philips Res. Rep.*, Nov. 1946, Vol. 1, No. 5, pp. 361–379.) The power factor is measured by determining the increase in damping of a tuned circuit when a capacitor formed from the dielectric is connected in parallel. The details of this method and the apparatus used for determining the temperature coefficient of the dielectric constant are discussed. Sources of error and the necessary corrections are indicated. For previous parts see 125 of January, 1476 of May and 3548 above.

621.317.1.011.5 **3573**

A Method for Measuring Certain Electric Constants at Centimetre Wavelengths.—K. G. Knorre. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 117–123. In Russian.) A rectangular cavity resonator is considered with ideally conducting walls and divided into three zones each representing a different dielectric medium (Fig. 1). The discussion is limited to H-waves and systems of equations (3) and (7) are derived determining the field in each zone. On the basis of the results obtained a method is proposed for measuring the dielectric constant of a medium. The method is based on obtaining resonance by moving one of the end walls of the resonator. The damping of a resonator containing a dielectric is discussed and also the possibility of measuring losses in the dielectric.

621.317.3 : 621.396.611.21 **3574**

Electrical Characteristics of Quartz-Crystal Units and Their Measurement.—W. D. George, M. C. Selby & R. Scolnik. (*Bur. Stand. J. Res.*, March 1947, Vol. 38, No. 3, pp. 309–328.) *Q*-meters and r.f. bridges were used. Measurement methods and their relative merits and limitations are discussed. Antiresonance impedance up to 5 MΩ was measured to within ±5%. Constancy of electrical characteristics, secondary responses, and changes with amplitude of vibration and temperature were investigated for many 8.7-Mc/s BT-cut crystal units and a few 50-kc/s and 100-kc/s units. A graphical method of representing the electrical characteristics of normal crystal units is suggested.

621.317.333.82 : 621.319.4 **3575**

Overvoltage Testing of Capacitors.—R. J. Hopkins. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 105–107.)

621.317.336.1 : [621.385.3/.5 **3576**

The Measurement of Dynamic Mutual Conductance of Valves using the Grounded-Grid Triode Mode of Operation.—F. Gutmann. (*J. sci. Instrum.*, April 1947, Vol. 24, No. 4, pp. 94–95.) The valve under test is connected as a cathode-loaded grounded-grid triode and a known alternating voltage in series with a current indicator is applied across the load. The measured current is approximately proportional to the dynamic mutual conductance.

621.317.361 **3577**

F.C.C. Frequency Measurement Techniques.—A. K. Robinson. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 114–116.) The system depends on a primary 50-kc/s standard, of accuracy greater than 1 in 10^7, with frequency subdivision to 50 c/s for comparison check with standard time signals. 10-kc/s markers, derived from the standard, extend up to 500 Mc/s by use of a high-gain harmonic amplifier having individual harmonic output constant with frequency. The external signal to be checked is made to beat with the nearest marker. The beat note is measured by an audio interpolation oscillator, range 0–5 kc/s, accuracy ±2 c/s, used with an oscilloscope. Provision is made for sense determination. Signals of short duration are checked by means of a heterodyne frequency meter.

621.317.382 : 621.385.831 **3578**

Power Measurement of Class B Audio Amplifier Tubes.—D. P. Heacock. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 147–157.) An accurate method, particularly suitable for production tests, of determining the performance by a simple measurement of the anode current of one of the two valves.

621.317.44.025 **3579**

An Alternating Current Probe for Measurement of Magnetic Fields.—E. C. Gregg, Jr. (*Rev. sci. Instrum.*, Feb. 1947, Vol. 18, No. 2, pp. 77–80.) A summarized account of this probe was noted in 3184 of October. Advantage is taken of the fact that the a.c. permeability of most magnetic alloys changes with superposed steady-state d.c. magnetic fields.

621.317.49 : 534.321.9 **3580**

Comparison of Supersonic Intensities by means of a Magnetostriction Gauge.—A. W. Smith & D. K. Weimer. (*Rev. sci. Instrum.*, March 1947, Vol. 18, No. 3, pp. 188–190.) The gauge consists essentially of a small rod of Ni wound with a few turns of wire. The acoustic pressures present in the liquid produce changes in length of the rod which in turn, because of the inverse magnetostrictive effect, induce voltages in the coil.

621.317.7 + 621.38 + 621.396.69 **3581**

The Physical Society's Exhibition.—(*Engineer, Lond.*, 18th & 25th April & 2nd May 1947, Vol. 183, Nos. 4760–4762, pp. 328–331, 352–353 & 383–385; *Engineering, Lond.*, 2nd May 1947, Vol. 163, No. 4240, pp. 364–366.) Descriptions of further selections of the exhibits in the trade and research sections. See also 3185 of October and 2494 of August.

621.317.7.029.62/.63 : [621.396.81 + 621.396.822 **3582**

A V.H.F./U.H.F. Noise and Field Intensity Meter.—L. W. Martin. (*Communications*, June 1947, Vol. 27, No. 6, pp. 32–35, 44). Description, with complete circuit diagram, of equipment for noise measurement in μV or db and field-intensity measurement in μV/m, in the frequency range 88–400 Mc/s.

621.317.725 **3583**

A Very High Impedance R.M.S. Voltmeter for Iron Testing.—K. A. Macfadyen : D. C. Gall & F. C. Widdis. (*J. sci. Instrum.*, April 1947, Vol. 24, No. 4, p. 109.) Discussion of 1514 of May. Input impedance up to 80 MΩ is achieved by returning the grid leak to a positive voltage. The relative merits of current and voltage feedback are considered.

621.317.725.027.7 **3584**

The Design of an Ellipsoid Voltmeter for the Precision Measurement of High Alternating Voltages.—F. M. Bruce. (*J. Instn elect. Engrs*, Part II, April 1947, Vol. 94, No. 38, pp. 129–137. Discussion, pp. 149–154.) High alternating voltages are measured by timing the oscillations of a small ellipsoid suspended by a thread in the uniform electric field between two parallel vertical disks. By accurate mechanical construction, and correction of the results for known sources of error, the voltage between the disks is deduced with an estimated error of less than ±0.3%. See also 3585 below. Summary *ibid.*, Part I, June 1947, Vol. 94, No. 78, p. 279.

621.317.728.089.6 **3585**
Calibration of Uniform-Field Spark-Gaps for High-Voltage Measurement at Power Frequencies.—F. M. Bruce. (*J. Instn elect. Engrs*, Part II, April 1947, Vol. 94, No. 38, pp. 138–149. Discussion, pp. 149–154.) Description of spark gaps using electrodes shaped to give a uniform field in the gap. A calibration beween 9 and 315 kV is given, agreeing with a simple empirical formula to within ±0.2%. See also 3584 above. Summary *ibid.*, Part I, June 1947, Vol. 94, No. 78, pp. 279–280.

621.317.75 **3586**
A Rotary Periodograph.—G. B. Moncrieff-Yeates. (*J. sci. Instrum.*, Feb. 1947, Vol. 24, No. 2, pp. 35–40.) An instrument for the rapid analysis of disturbed periodic functions. The variance, obtained photoelectrically, of the sum of two ordinates is plotted against their separation to produce a 'characteristic curve' containing many of the constants required.

621.317.755 : 621.3.015.3 : 621.311.1 **3587**
Oscillographs for Rapid Transient Phenomena. Their Application to the Study of Overvoltages in Grid Systems.—P. Grassot. (*Bull. Soc. franç. Élect.*, Feb. 1947, Vol. 7, No. 66, pp. 95–101.) Short descriptions of various modern instruments, with applications to surge investigations.

621.317.761 + [621.396.615.12 : 621.317.79 **3588**
A V.H.F. Signal Generator or Frequency Meter.—J. G. Ratcliff. (*R.S.G.B. Bull.*, Feb. 1947, Vol. 22, No. 8, pp. 118–122.) Describes a compact heterodyne frequency meter, covering the range 5–250 Mc/s, which can also be used as a tone-modulated source of r.f. voltage. Six plug-in coils are used and crystal check points are provided at 2- and 10-Mc/s intervals. Transitron multivibrators give division down to 500 or 100 kc/s.

621.317.763.029.64 **3589**
Direct Reading Wavemeters.—G. E. Feiker & H. R. Meahl. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 59.) Summary of I.R.E. paper. An account of loop-coupled quarter-wave coaxial wavemeters for use in the 8–12 and 12–17 cm wavelength ranges. Resonance is indicated by a crystal-valve voltmeter. Accuracy is within 0.1%.

621.317.772.029.64 : 621.396.67 **3590**
Phase-Front Plotter for Centimeter Waves.—H. Iams. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 270–275.) The area to be plotted is scanned by a motor-actuated probe. The energy picked up by the probe at any point is combined with a reference signal and applied to a detector. The detector output, which varies with the phase difference between the probe and reference signals, is amplified and applied to a stylus directly below the probe; a sheet of current-sensitive paper is thus darkened in proportion to the detector output and a record is obtained showing which parts of the area have the same phase. The plotter was used to test centimetre wave aerials.

621.317.79 : 621.396.822 **3591**
Distortion-Noise Meter.—C. W. Clapp. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 61.) Summary of I.R.E. paper. A bridged-T type filter covering 50–15 000 c/s rejects the fundamental whilst passing harmonics. The circuit can be adapted for use as a noise meter.

621.317.79 : 621.396.96 **3592**
Echo Boxes for Radar Testing.—R. W. Marshall. (*Bell. Lab. Rec.*, March 1947, Vol. 25, No. 3, pp. 111–113.) A short account of typical constructions and their use to indicate overall performance of radar installations.

621.396.619.083 : 621.397.5 **3593**
A Method of Measuring the Degree of Modulation of a Television Signal.—T. J. Buzalski. (*RCA Rev.*, June 1946, Vol. 7, No. 2, pp. 265–271.) The double sideband output of the transmitter energizes a linear diode monitor, the output of which contains a d.c. component in addition to the visual signal. This composite signal is short-circuited periodically by a 'Vibroswitch' thus establishing a zero level. The amplitudes of the components of the resultant trace may be read directly on an oscilloscope and the modulation percentage calculated.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9 : 531.717 : 621.436-222 **3594**
Ultrasonic Measurement of Wall Thickness in Diesel Cylinder Liners.—F. W. Struthers & H. M. Trent. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 368–371.)

535.61-15 : 621.389 **3595**
Infra-Red Equipment for Military Purposes.—(*Engineering, Lond.*, 4th April 1947, Vol. 163, No. 4236, p. 258.) For another account see 2862 of September.

535.61-15 : 621.391.64 : 621.327.032.196 **3596**
Cesium Vapor Lamps.—N. C. Beese. (*J. opt. Soc. Amer.*, Oct. 1946, Vol. 36, No. 10, pp. 555–560.) Structural details and characteristics of lamps giving infra-red radiation and capable of 100% current modulation throughout the a.f. range.

537.533.73 : 539.2 **3597**
Electron Diffraction. Apparatus used in France and Abroad. Possibilities of the Method for Crystal Analysis of Thin Plates and for Surface Structure.—J. Devaux. (*Bull. Soc. franç. Élect.*, Feb. 1947, Vol. 7, No. 66, pp. 111–115.)

538.71.001.8 + 538.71 : [623.26 + 623.95 **3598**
Bomb and Mine Location: Peace-Time Applications.—(*Beama J.*, April 1947, Vol. 54, No. 118, pp. 139–140.) A short account of the E.R.A. mumetal magnetometer and balanced-coil locator, with applications to the location of sunken anchor buoys and other equipment in the Seine estuary.

550.837 : 621.396.675 **3599**
Electric Field of an Oscillating Dipole on the Surface of a Two Layer Earth.—Wolf : Lewis. (*See* 3435 and 3436.)

550.837.7 **3600**
On the Use of Electromagnetic Waves in Geophysical Prospecting.—C. W. Horton. (*Geophys.*, Oct. 1946, Vol. 11, No. 4, pp. 505–517.) The response of the earth to a d.c. step function is analysed for the case in which displacement currents are negligible. It is shown that under typical conditions the depth of an electrical interface 6 000 ft below ground can be measured by means of e.m. waves, even thin layers of salt water or oil-bearing sand giving measurable effects.

550.837.7 : 621.396.9 **3601**

Use of the Broadcast Band in Geologic Mapping.—L. Kerwin. (*J. appl. Phys.*, April 1947, Vol. 18, No. 4, pp. 407–413.) A description of field equipment to study the effect of geologic anomalies on e.m. field intensity, with experimental results.

551.46.018.3 : 621.317.39 **3602**

The Measurement of Sea-Water Velocities by Electromagnetic Induction.—R. W. Guelke & C. A. Schoute-Vanneck. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 232.)

621.191.33 : 534.321.9 **3603**

The Detection of Internal Leaks in Aircraft Hydraulic Systems.—R. G. Nuckolls & H. M. Trent. (*J. acoust. Soc. Amer.*, March 1947, Vol. 19, No. 2, pp. 364–367.) A crystal pickup and amplifier which monitor " the ultrasonic vibrations produced in the system by the leaking valve, which vibrations are most intense at the defective element".

621.318.572 **3604**

Vane-Actuated Controller.—Wannamaker. (*See* 3444.)

621.365.5 **3605**

Temperature Charts for Induction and Constant-Temperature Heating.—M. P. Heisler. (*Trans. Amer. Soc. mech. Engrs*, April 1947, Vol. 69, No. 3, pp. 227–236.) " Charts are presented for determining complete temperature histories in spheres, cylinders and plates."

621.38/.39].001.8 **3606**

Radar Techniques in an Industrial Control.—W. D. Cockrell. (*Elect. Engng, N.Y.*, April 1947, Vol. 66, No. 4, pp. 365–368.) A description of u.h.f. methods for register control in the printing and paper industries.

621.38 : 6(048) **3607**

Industrial Electronic Equipment Uses : Part 2.—W. C. White. (*Electronic Industr.*, April 1947, Vol. 1, No. 4, p. 6.) Continuation of 2520 of August. A further list of 123 references.

621.384.6 **3608**

Atomic Artillery.—J. Stokley. (*Gen. elect. Rev.*, June 1947, Vol. 50, No. 6, pp. 9–19.) An outline of the various types of electron and ion accelerators which have been used to produce streams of atomic particles of high energy. The principles of operation of the cyclotron, synchro-cyclotron, betatron and synchrotron are described and mention is made of a new type of linear accelerator expected to produce particles with an energy of 40 MeV, in which radar pulse transmitters will provide the energy source.

621.384.6 : 621.316.7 **3609**

The Synchronization of Auxiliary Apparatus with a Betatron.—G. C. Baldwin, G. S. Klaiber & A. J. Hartzler. (*Rev. sci. Instrum.*, Feb. 1947, Vol. 18, No. 2, pp. 121–124.) Automatic control by external apparatus, such as a cloud chamber, of the production of X-rays by a betatron is described. Upon receiving an initiating signal from the cloud chamber a relay and thyratron circuit permits injection of electrons into the betatron vacuum tube only during a single cycle. Three thyratrons furnish a series of synchronizing signals.

621.385.833 **3610**

Present Status and Future Possibilities of the Electron Microscope.—J. Hillier. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 29–42.)

621.385.833 **3611**

The Electron Microscope.—P. Grivet. (*Bull. Soc. franç. Élect.*, Feb. 1947, Vol. 7, No. 66, pp. 102–110.) A description of some of the special features of the C.S.F. electrostatic instrument, with microphotographs of widely differing objects. See also 3706 of 1946.

621.385.833 **3612**

The Electron Optical System of the Electron Microscope.—M. E. Haine. (*J. sci. Instrum.*, March 1947, Vol. 24, No. 3, pp. 61–66.) Theoretical and practical considerations in the design and use of the microscope.

621.385.833 **3613**

On the Limit of Resolution of the Electron Microscope. Unsymmetrical Lens.—H. Bruck. (*C. R. Acad. Sci., Paris*, 9th June 1947, Vol. 224, No. 23, pp. 1628–1629.) Formulae for the limit are derived which depend on the lack of symmetry in the objective lens. Similar formulae are given for the optical case. The formulae hold in all cases where lack of symmetry is a more serious defect than spherical aberration. See also 3238 of October.

621.385.833 **3614**

Conditions for extending the Resolution Limit of the Electron Microscope.—V. E. Cosslett. (*J. sci. Instrum.*, Feb. 1947, Vol. 24, No. 2, pp. 40–43.) The limiting resolution obtainable with magnetic lenses of existing type may be reduced from 10 Å to perhaps 6 Å by the use of a sufficiently high accelerating voltage, provided that the lens power is maintained at the value which gives minimum aberration. Further improvement can only be obtained by correction of lens aberrations.

621.385.833 **3615**

Preparation and Uses of Silica Replicas in Electron Microscopy.—C. H. Gerould. (*J. appl. Phys.*, April 1947, Vol. 18, No. 4, pp. 333–343.) A method is described for preparing silica replicas of specimens which cannot be subjected to the temperatures and pressures of the ordinary technique.

621.386.1 **3616**

X-Ray Generators for 1 000 and 2 000 kV.—J. Saget. (*Bull. Soc. franç. Élect.*, May 1947, Vol. 7, No. 69, pp. 273–274.) Discussion on 1547 of May.

621.386.1 : 615.849 **3617**

A 400 Kilovolt Installation for X-Ray Therapy.—W. H. Boldingh & W. J. Oosterkamp. (*Philips tech. Rev.*, April 1946, Vol. 8, No. 4, pp. 105–110.) A novel construction, with the anode earthed and the focus at the end of a long earthed metal tube projecting through a partition into the irradiation chamber.

621.791.736.31 **3618**

Precision Energy-Storage Spot Welder.—R. Briggs & H. Klemperer. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 102–104.)

623.454.25 : 621.396.9 **3619**

Radio Proximity Fuze.—(*Tech. Bull. nat. Bur. Stand.*, Jan. 1947, Vol. 31, No. 1, pp. 3–8.) An account of the development of the fuse at the National Bureau of Standards, Washington. See also 623, 624 and 1627 of 1946.

PROPAGATION OF WAVES

538.566+621.396.11 **3620**

On the Propagation of Electromagnetic Waves through the Atmosphere.—B. K. Banerjea. (*Proc. roy. Soc. A*, 17th June 1947, Vol. 190, No. 1020, pp. 67–81.) "A general method of tackling the problem of the propagation of electromagnetic waves in the ionosphere has been developed and the current methods of Appleton, Hartree, Saha, Rai and Mathur, etc., have been deduced as special cases from the general results. The different assumptions by Appleton, Hartree, Bose, Booker and Rai, as regards the condition of reflexion of the waves from the ionosphere, have been shown to be identical. A symbol-correspondence chart for the different symbols used by the different workers has been given to facilitate the understanding of the parallelism between the different methods. Polarization of the radio waves has been discussed fully."

538.566 **3621**

[One-Dimensional] **Propagation of a Perturbation, of Narrow Frequency Range, in a Non-Absorbing Dispersive Medium.**—Blanc-Lapierre & Lapostolle. (*See* 3505.)

551.510.535 : 621.396.24 **3622**

Application of the Theories of Indirect Propagation to the Calculation of Links using Decametre Waves.—Aubert. (*See* 3654.)

621.396.11 **3623**

On the Problem of Efficient Long-Distance Wireless Power Transmission.—S. Tetelbaum. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 6, pp. 505–514.)

621.396.11 : 534.231 **3624**

A Device for Plotting Rays in a Stratified Medium.—Lawson, Miller & Schiff. (*See* 3389.)

621.396.11 : 551.510.535 **3625**

Radiation Angle Variations from Ionosphere Measurements.—H. E. Hallborg & S. Goldman. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 342–351.) "The heights of the F and F_2 layers at Washington, D.C., and San Francisco, California, and their variability ranges are studied for the year 1945. These data are applied to determine the optimum radiation angle ranges for various hop modes on the New York - San Francisco Circuit. Wide diurnal and seasonal variations are indicated. Practical applications to effective antenna design are discussed."

621.396.11 : 551.510.535 **3626**

The Role of the Ionosphere in the Propagation of Radio Waves.—Jouaust. (*See* 3520.)

621.396.11 : 551.510.535 **3627**

Radio Investigation of the Ionosphere.—Bakker. (*See* 3519.)

621.396.11.029.62/.63 **3628**

Propagation Studies on 45.1, 474, and 2 800 Megacycles within and beyond the Horizon.—G. S. Wickizer & A. M. Braaten. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 670–680.) Recordings of field strength on 2 800, 474 and 45.1 Mc/s over a period of 13 months were made at distances of 42 miles (within the horizon) and 70 miles (beyond the horizon) from the transmitter. Maximum values 3 or 4 times the free-space values were obtained at the two higher frequencies. Variations at 474 and 2 800 Mc/s were greater than those at 45.1 Mc/s; variations at 70 miles were greater than those at 42 miles. Refraction was found to be greater in summer; superrefraction only occurred when the wind velocity was less than about 13 m.p.h. Simultaneous meteorological observations were made.

621.396.41.029.64 **3629**

Calculation of Multiplex U.H.F. Radio-Telephone Links.—H. Chireix. (*Bull. Soc. franç. Élect.*, May 1947, Vol. 7, No. 69, pp. 271–272.) Discussion on 1559 of May.

621.396.81 **3630**

V.H.F. Propagation Surveys for Mobile Services.—R. G. Peters. (*Communications*, June 1947, Vol. 27, No. 6, pp. 20 . . 45.)

621.396.812.029.62 **3631**

Propagation on Five.—E. J. Williams & D. W. Heightman. (*Short Wave Mag.*, Feb. 1947, Vol. 4, No. 12, pp. 749–751.) Criticism of 1561 of May; for Russell's reply see 3632 below.

621.396.812.029.62 **3632**

More about V.H.F. Propagation.—O. J. Russell. (*Short Wave Mag.*, March 1947, Vol. 5, No. 1, pp. 46–48.) A reply to criticism in 3631 above of 1561 of May.

621.396.812.029.64 **3633**

Research in England on the Propagation of Ultra-Short Waves.—Bras. (*Bull. Soc. franç. Élect.*, May 1947, Vol. 7, No. 69, pp. 270–271.) Discussion on 1563 of May.

621.396.812.4.029.62 **3634**

Tropospheric Reception.—G. W. Pickard & H. T. Stetson. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 54.) Summary of I.R.E. paper. Daily records of field strength of W2XMN f.m. transmissions on 42.8 Mc/s show variations dependent upon the passage of warm and cold fronts across the transmission path. Reception at 167 miles range was, on the average, three to four times stronger in summer than in winter.

RECEPTION

621.396.621 **3635**

Modernizing the Old Receiver.—W. L. North. (*QST*, April 1947, Vol. 31, No. 4, pp. 54–55, 130.) Details of alterations to an RME-69 receiver resulting in considerable improvement in both gain and image rejection.

621.396.621 **3636**

Criteria for Diversity Receiver Design.—W. Lyons. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 373–378.) Discussion limited to receivers incorporating diode switching of the common diode load variety.

621.396.621 : 621.395.623.66 **3637**

The Pocket Ear.—J. L. Hathaway & W. Hotine. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 139–146.) The development of a three-valve pocket radio receiver, with a flexible tube for conducting sound to the ear, for maintaining contact between a programme producer and a roving announcer.

621.396.621 : 621.396.619.11 **3638**

The Synchrodyne.—F. G. Apthorpe : D. G. Tucker. (*Electronic Engng*, July 1947, Vol. 19, No. 233, p. 238.) Comment on 2364 of August. Comparison is made with the 'Homodyne' (F. M. Colebrook, *Wireless World and Radio Review*, 1924, Vol. 13, pp. 645–648.) Apthorpe considers distortion of a signal subject to selective fading by reference to vector diagrams and discusses the advantages of harmonic synchronization, and methods for avoiding the howl when off tune. Tucker stresses the essential difference between the homodyne and the synchrodyne, pointing out that whereas the homodyne gives selectivity in preference to quality, in the synchrodyne selectivity and quality are quite independent and both may be excellent.

621.396.621.001.4 : 621.396.82 **3639**

Static for Radio Receiver Tests.—J. C. R. Licklider & E. B. Newman. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 98–101.) Apparatus for artificial production of 'atmospherics'.

621.396/.397].621.004.67 **3640**

The Servicing of Radio and Television Receivers.—R. C. G. Williams. (*J. Instn elect. Engrs*, Part I, March 1947, Vol. 94, No. 75, pp. 156–158.) Summary of 2224 of July.

621.396.621.5.029.62 **3641**

R.F./Mixer Design for V.H.F.—W. J. Crawley. (*Short Wave Mag.*, March 1947, Vol. 5, No. 1, pp. 44–46.) Describes the development of a circuit for 58 Mc/s with two high-gain r.f. stages ; it uses a low-noise h.f. pentode and split-stator tuning capacitors.

621.396.621.54 **3642**

The Inversion of the Autodyne Principle.—Saic. (*See* 3472.)

621.396.622.71 **3643**

The Ratio Detector.—S. W. Seeley & J. Avins. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 201–236.) "In this circuit two frequency-sensitive voltages are applied to diodes and the sum of the rectified voltages held constant. The difference voltage then constitutes the desired a.f. signal. This means of operation makes the output insensitive to amplitude variations.

". . . The ratio between the primary and secondary components of the frequency-sensitive voltages in a phase-shift type of ratio detector is a function of the instantaneous signal amplitude. The a.m. rejection properties, however, are shown to depend upon the mean ratio between these voltages. An expression which is developed for this ratio in terms of the circuit parameters provides the basis for arriving at an optimum design. The measurements necessary in the design of a ratio detector and in checking its performance are described."

621.396.812.4.029.62 **3644**

Tropospheric Reception.—Pickard & Stetson. (*See* 3634.)

621.396.822 : 621.396.621 **3645**

On the Theory of Noise in Radio Receivers with Square Law Detectors.—M. Kac & A. J. F. Siegert. (*J. appl. Phys.*, April 1947, Vol. 18, No. 4, pp. 383–397.) "For the video output V of a receiver, consisting of an i.f. stage, a quadratic detector, and a video amplifier, the probability density $P(V)$ has been obtained for noise alone and for noise and signal. The results are expressed in terms of eigenvalues and eigenfunctions of the integral equation

$$\int_0^\infty K(t)\rho(s-t)f(t)dt = \lambda f(s),$$

where $\rho(\tau)$ is the i.f. correlation function (i.e., the Fourier transform of the i.f. power spectrum) and $K(t)$ is the response function of the video amplifier (i.e., the Fourier transform of the video amplitude spectrum). Two special cases are discussed in which the integral equation can be solved explicitly. Approximations for general amplifiers are given in the limiting cases of wide and narrow videos." Summary abstracted in 1199 of April.

621.396.822.029.6 : 621.385.2 **3646**

A Coaxial-Line Diode Noise Source for U.H.F.—Johnson. (*See* 3722.)

621.396.828 **3647**

A New Noise-Reducing System for C.W. Reception.—D. L. Hings. (*QST*, June 1947, Vol. 31, No. 6, pp. 21–23, 134.) Full details of a practical circuit for application to the second detector and a.f. end of a communications receiver. See also 1576 of May and 3649 below.

621.396.828 **3648**

A Method for preventing Impulse Interference with Radio Reception.—A. N. Shchukin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 49–56. In Russian.) The receiver is assumed to consist of a wide-band unit, followed by an amplitude limiter which in turn is followed by a narrow-band unit. The operation of the system is considered when one or more impulses are received in the presence or absence of the desired signal. Formulae are derived determining the ratio of the interference voltage at the output of the receiver to the corresponding useful signal voltage if there were no interference. The interference from another radio station operating at a frequency lying within the wide but outside the narrow band is also considered.

621.396.828 : 621.394.141 **3649**

Noise-Free Code Reception.—D. L. Hings. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 125–127.) A method for discriminating between the time constants of signal and noise, allowing c.w. signals to trigger an a.f. generator feeding a loudspeaker. See also 1576 of May and 3647 above.

STATIONS AND COMMUNICATION SYSTEMS

621.391.64 **3650**

Infrared Communications.—M. C. Beese. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 53.) Summary of I.R.E. paper.

621.394/.395].7(68.01) **3651**

Communications Network of the Union of South Africa.—D. P. J. Retief. (*Trans. S. Afr. Inst. elect. Engrs*, March 1947, Vol. 38, Part 3, pp. 84–112.) The development since the introduction of voice-frequency amplifiers in 1922 is described, with particular reference to recent expansions.

621.395.5 : 621.396.5 **3652**

Wire or Wireless?—T. Roddam. (*Wireless World*, July 1947, Vol. 53, No. 7, pp. 236–238.) Outlines the future possibilities of wide-band f.m. v.h.f. links for the trunk communications at present handled by telephone lines.

621.396.1 **3653**

F.C.C. makes Allocations for Short-Distance Communication.—(*Electronics*, June 1947, Vol. 20, No. 6, p. 152.) Brief survey of the allocation of frequencies in the 152–162-Mc/s band.

621.396.24 : 551.510.535 **3654**

Application of the Theories of Indirect Propagation to the Calculation of Links using Decametre Waves.—R. Aubert. (*Bull. Soc. franç. Élect.*, May 1947, Vol. 7, No. 69, pp. 265–270.) Discussion on 1210 of April.

621.396.3 : 621.396.933 **3655**

International Commercial Aviation Radioteletype Systems.—F. V. Long. (*Communications*, June 1947, Vol. 27, No. 6, pp. 24–26 . . 43.)

621.396.41 : 621.396.619.16 **3656**

Multiplex Broadcasting.—A. M. Levine. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 55.) Summary of I.R.E. paper. A system using time division multiplexing and pulse-time modulation for eight programmes each of bandwidth 9.5 kc/s, on a single 930-Mc/s carrier. See also 1213 of April (Grieg & Levine) and 3657 below.

621.396.41 : 621.396.619.16 : 621.396.97 **3657**

Multiplex Broadcasting.—F. Altman & J. H. Dyer. (*Elect. Engng, N.Y.*, April 1947, Vol. 66, No. 4, pp. 372–380.) Multiplex operation and methods of modulation are briefly discussed with special reference to pulse-time modulation. An eight-channel system working on 930 Mc/s and incorporating the cyclophon is described. The cyclophon, a special c.r. tube with rotating electron beam which acts as a cyclic switch and modulator or demodulator, is discussed in detail. The advantages of multiplex operation are summarized. See also 239 of January, 1213 of April (Grieg & Levine) and 3656 above.

621.396.41.029.64 **3658**

Calculation of Multiplex U.H.F. Radio-Telephone Links.—Chireix. (*See* 3629.)

621.396.5 **3659**

Experimental Rural Radiotelephony.—J. H. Moore, P. K. Seyler & S. B. Wright. (*Elect. Engng, N.Y.*, April 1947, Vol. 66, No. 4, pp. 346–348.) A description of an experimental radio installation on 44–50 Mc/s, worked on the party line system, for isolated rural communities having no telephone facilities.

621.396.619.11/.13 **3660**

Comparison of Amplitude and Frequency Modulation.—M. G. Nicholson. (*Wireless Engr*, July 1947, Vol. 24, No. 286, pp. 197–208.) Comparisons of performance have previously been made between f.m. on 40–50 Mc/s with a channel width of about 200 kc/s and a.m. at a signal frequency of 1 Mc/s or less with a channel width of about 10 kc/s. The present comparison is made under conditions of frequency stability, channel width and receiver bandwidth normally realized in the v.h.f. band.

It is concluded that f.m. is superior to a.m. only where fluctuation noise is the limiting factor. As regards interference, a.m. is superior to f.m. even if the selectivity of the a.m. receiver is identical with that of the f.m. receiver. A.m. has better discrimination against impulse noise, is less adversely affected by imperfect tuning and is superior to f.m. in ' satellite ' station operation. See also 3661 below (G.W.O.H.).

621.396.619.11/.13 **3661**

Amplitude and Frequency Modulation.—G.W.O.H. (*Wireless Engr*, July 1947, Vol. 24, No. 286, p. 191.) Refers to Nicholson's paper (3660 above) and stresses that the merits of the two modulation systems must be compared under similar conditions.

621.396.619.13 : 518.3 **3662**

Radiation Chart for F.M. Stations.—C. F. Guthrie. (*Communications*, May 1947, Vol. 27, No. 5, pp. 34–36.) For determining the effective radiated power, a parameter required in Everett's range prediction chart (736 of 1946).

621.396.931 **3663**

V.H.F. Railroad Communications in Tunnels.—J. P. Shanklin. (*Communications*, June 1947, Vol. 27, No. 6, pp. 16–19.) Preliminary field strength measurements made in a disused water tunnel were followed by the erection of a train communication system in a railway tunnel 2 760 ft long. 152–162-Mc/s signals were fed into transmission lines in the crown of the tunnel from an external rhombic aerial. Reflecting wires were placed above the transmission lines to reduce signal loss.

621.396.931 **3664**

V.H.F. Radio Equipment speeds up Railroad Operation.—L. G. Sands. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 38–41 . . 111.) A description of modern two-way f.m. equipment used on U.S. railways.

621.396.931.029.62 **3665**

Mobile F.M. Communications Equipment for 30 to 44 Mc/s.—R. B. Hoffman & E. W. Markow. (*Communications*, June & Aug. 1947, Vol. 27, Nos. 6 & 8, pp. 28–29 . . 41 & 34–35.) The transmitter uses a crystal-controlled master oscillator, phase-shift variable transconductance modulation and four frequency-multiplying and amplifying stages. The receiving selective-calling system uses a two-valve Wien-bridge oscillator circuit.

621.396.932 **3666**

Radio for Merchant Ships. [Book Notice]—H.M. Stationery Office, 1s. (*Govt Publ., Lond.*, April 1947, p. 12.) Performance specifications.

621.396.932 : [620.178+620.193 **3667**

Radio and Radar for Merchant Ships. [Book Notice]—H.M. Stationery Office, 2d. (*Govt Publ., Lond.*, April 1947, p. 12.) A performance specification for the climatic and durability testing of marine radio and radar equipment.

SUBSIDIARY APPARATUS

621.313.2-9 **3668**

Sub-Miniature D.C. Motors.—(*Electrician*, 2nd May 1947, Vol. 138, No. 3594, pp. 1157–1159.) For another account see 2943 of September.

621.314.632 : 621.315.59 **3669**

Contact Potential Difference in Silicon Crystal Rectifiers.—W. E. Meyerhof. (*Phys. Rev.*, 15th May 1947, Vol. 71, No. 10, pp. 727–735.) Measurements show no correlation between the work function differences and the contact potential difference, which is practically independent of the metal used and also of the structure of the silicon surface.

621.314.65+537.525.5 **3670**

On the Mechanism of Dielectric Ignition and Resistance Ignition in Mercury Arc Rectifiers. [Thesis]—N. Warmoltz. (*Philips Res. Rep.*, Nov. 1946, Vol. 1, No. 5, p. 379.) Summary only. A short survey based on the field theory of the low-pressure mercury arc.

621.316.53.029.5/.6 **3671**

A Design of Heavy-Current Contact, particularly for Radio-Frequency Use.—A. J. Maddock. (*J. Instn elect. Engrs*, Part I, May 1947, Vol. 94, No. 77, p. 233.) Summary of 2249 of July.

621.318.44 **3672**

Toroidal Coils. Improved Winding Machine.—E. R. Brooke. (*Elect. Rev., Lond.*, 29th Aug. 1947, Vol. 141, No. 3640, pp. 319–320.) Some details of a machine for quantity production of toroidal coils for transformers and chokes. Two rings are threaded on the core, both rings having detachable segments. One ring is channelled to carry enough wire for one winding, while the driving ring carries a wire feed pulley. The method of use for winding an 8-segment coil is described.

621.318.5 **3673**

Telephone Relays and Their Use in Electronic Circuits : Part 2.—A. A. Chubb. (*Electronic Engng*, July 1947, Vol. 19, No. 233, pp. 211–213.) Various a.c. and d.c. circuits for operating small telephone relays are given, and a complete circuit for remote control of a 1-kW transmitter and its associated receiver is described. For part 1 see 3294 of October.

621.396.68 : 621.397.5 **3674**

Television High Voltage R.F. Supplies.—R. S. Mautner & O. H. Schade. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 43–81.) A detailed consideration of the design of h.v. supply units using r.f. oscillators and voltage multiplier circuits. Sample calculations for a 75-W 90-kV supply and a 10-W 30-kV supply are included to illustrate the progressive steps in designing and calculating the circuit elements and operating conditions for a specified performance. For earlier work see 2169 of 1943 (Schade).

621.396.682 **3675**

A Special-Purpose Power Supply.—P. W. Howells. (*Gen. elect. Rev.*, June 1947, Vol. 50, No. 6, pp. 34–39.) A stabilized power pack with output continuously variable between 160 and 1 500 V at 0.125 A. Characteristics include a low-ripple output voltage and a low output impedance to minimize the possibility of undesired coupling between load circuits through the power supply.

TELEVISION AND PHOTOTELEGRAPHY

621.396/.397].62 : 621.396.67.029.62 **3676**

Aerials for Ultra-Short Waves : Part 1 — A Double Dipole for Television and F.M.—Maurice. (*See* 3433.)

621.396/.397].621.004.67 **3677**

The Servicing of Radio and Television Receivers.—R. C. G. Williams. (*J. Instn elect. Engrs*, Part I, March 1947, Vol. 94, No. 75, pp. 156–158.) Summary of 2224 of July.

621.397.2 **3678**

Developments in Picture Transmission.—J. J. E. Aspin. (*J. Instn elect. Engrs*, Part I, March 1947, Vol. 94, No. 75, p. 134.) Abstract of chairman's address to the South Midland Radio Group. A historical survey.

621.397.335 **3679**

New Techniques in Synchronizing-Signal Generators.—Schoenfeld, Brown & Milwitt. (*See* 3489.)

621.397.5 : 621.396.619.083 **3680**

A Method of Measuring the Degree of Modulation of a Television Signal.—Buzalski. (*See* 3593.)

621.397.5 : 621.396.68 **3681**

Television High Voltage R.F. Supplies.—Mautner & Schade. (*See* 3674.)

621.397.6 **3682**

Portable Camera Chain for Field Use.—L. Mautner. (*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 26–31 . . 109.) Wartime developments have permitted redesign of portable television cameras and associated control equipment for outside broadcast use. An image-orthicon type of pickup tube was chosen because of the wide range of sensitivity required and lack of shading available. A block diagram of a four-camera control system, and some circuit and construction details of camera-blanking methods, cable-delay compensation, and a camera control and monitor system are given.

621.397.6.001.8 **3683**

Simplified Television for Industry.—R. E. Barrett & M. M. Goodman. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 120–124.) Complete circuit details for a 250-line 60-frame television system, in which a new iconoscope simplifies the circuit and permits reproduction comparable to newspaper half-tones.

621.397.61 **3684**

The Paris Television Transmitting Centre.—H. Delaby. (*J. Televis. Soc.*, December 1946, Vol. 4, No. 12, pp. 307–313.) Translation of a French article abstracted in 1606 of May.

621.397.61-182.3 **3685**

Television O.B. [outside broadcast] **Vehicle.**—(*Wireless World*, July 1947, Vol. 53, No. 7, p. 241.) A 660-Mc/s transmitter complete with iconoscope cameras is housed in a car and obtains power from a 3.5-kW generator driven from the vehicle engine. The sound channel is conveyed by width-modulated pulses inserted in the line synchronization pulses and the 50-W output is fed to a beamed horizontal dipole at the top of a 40-ft telescopic mast.

621.397.62 **3686**

Television Receivers in Mass Production.—D.G.F. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 86–91.) Design features of the R.C.A. Victor postwar seven-inch, ten-inch and projection models. Summary of I.R.E. paper by A. Wright & E. Clark.

621.397.62 **3687**

Television Receiver Construction : Part 5.—(*Wireless World*, July 1947, Vol. 53, No. 7, pp. 251–257.) Line timebase and high voltage supply for the c.r.t. For earlier parts see 2595 of August and back references.

621.397.62 **3688**

Television Receivers.—A. Wright. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 5–28.) A detailed survey of R.C.A. direct viewing and projection type receivers with photographs and circuit diagrams. General circuit principles are considered. The r.f. tuner uses push-pull neutralized triode amplification, a push-pull triode frequency changer and switched coil tuning. The i.f. amplifier has staggered tuned circuits with rejection circuits tuned to adjacent channels. An unusual circuit for line synchronization, which is immune from interference, uses a stable sinusoidal oscillator whose phase is controlled by the line synchronization pulses. The magnetically focused cathode-ray tube has an ion trap to prevent ion bombardment of the screen from causing discoloration.

621.397.62 **3689**

Television Receiving Equipment. [Book Review]—W. T. Cocking. Iliffe & Sons, London, 2nd edn 1947, 339 pp., 12s. 6d. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, p. 706.) For another review see 2966 of September.

TRANSMISSION

621.317.76 **3690**

WWV — World Standard Frequency Generator.—(*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 42–43.) Photographs of some of the equipment used in the standard frequency transmissions.

621.391.63 : 621.325.53 **3691**

The Concentrated-Arc Lamp as a Source of Modulated Radiation.—W. D. Buckingham & C. R. Deibert. (*J. Soc. Mot. Pict. Engrs*, April 1947, Vol. 48, No. 4, pp. 324–340. Discussion, pp. 340–342.) A lamp using as radiation source a thin layer of molten zirconium maintained as an incandescent pool by intense argon ion bombardment. The radiation can be modulated at a.f. by modulating the lamp current. The use of suitable modulator circuits, with optical filters to select the best spectral region, enables the output to follow the current modulation with good fidelity.

621.396.1 **3692**

Types of Emission.—(*R.S.G.B. Bull.*, Feb. 1947, Vol. 22, No. 8, p. 124.) Recommendations accepted by the G.P.O. for the bands allotted to British amateurs are :

1.75, 3.5, 7 and 14 Mc/s ; c.w., a.m.
28 and 58.5 Mc/s ; c.w., m.c.w., a.m., f.m.
2 300–2 450 Mc/s ; any type of emission, including television but excluding pulse transmission.

621.396.61 **3693**

The Radio Mike.—J. L. Hathaway & R. Kennedy. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 251–258.) A smaller, lighter and more efficient transmitter to replace the N.B.C. ' beermug '. The design, uses and tests applied are described.

621.396.61 : 621.396.712 **3694**

Placing a 3-kW F.M. Broadcast Transmitter in Operation.—R. G. Soule, Jr. (*Communications*, May 1947, Vol. 27, No. 5, pp. 16–18..46.) Preliminary tests of the area were made with a 50-W unit which is described. The transmitter itself has a four-bay circular aerial and provides 8.5 kW radiated power.

621.396.61.029.62 **3695**

A Low-Cost 2-Meter Transmitter.—E. P. Tilton. (*QST*, April 1947, Vol. 31, No. 4, pp. 26–29..122.) Circuit and constructional details of a stabilized modulated oscillator with an output of about 3.5 W.

621.396.61.029.62 **3696**

BC-625 on 144 Mc/s.—L. W. May, Jr. (*Radio Craft*, April 1947, Vol. 18, No. 7, pp. 35–36, 75.) Complete circuit details of the modifications necessary to convert the transmitter of the army SCR-522 set for amateur use.

621.396.611.21 : 621.316.726.078.3 : 621.396.712 **3697**

Improvements in Synchronisation of B.B.C. Transmitters : 1938-1946.—W. E. C. Varley. (*B.B.C. Quart.*, April 1947, Vol. 2, No. 1, pp. 51–58.) A review of the development of frequency control of broadcasting transmitters from the pre-1938 tuning fork drive to the present crystal drive. The performance of various crystal-controlled oscillators is given and the technique of frequency comparison described with circuit details.

621.396.615.141.2 **3698**

Modulated Magnetrons.—L. P. Smith, J. Kurshan & J. S. Donal. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 57.) Summary of I.R.E. paper. Picture or audio signals control the electron guns and cause the magnetron to generate a f.m. wave without a.m. Under the influence of a static magnetic field and a r.f. electric field, an electron beam follows a spiral path within the cavity and applies f.m. to the natural resonant frequency of the magnetron. For general discussion of this technique and two specific applications, see 3699, 3730 and 3731 below.

621.396.615.141.2 : 621.316.726 **3699**

Frequency Modulation and Control by Electron Beams.—L. P. Smith & C. I. Shulman. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 644–657.) General formulae for the effect of electron beams on resonant systems in terms of frequency shift and change in *Q* are derived both from the point of view of lumped circuits and also from a general electromagnetic field standpoint. Check measurements of the frequency shift produced by such a beam in a multivane magnetron are described. It is shown that this method of frequency control is ideal for frequency modulation or automatic frequency stabilization of magnetrons and that for the former purpose the amplitude and phase distortions are negligible.

621.396.619.11/.13 **3700**

Generalized Theory of Multitone Amplitude and Frequency Modulation.—L. J. Giacoletto. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 680–693.) The frequency spectra produced by single-tone, two-tone and multitone modulating signals in the case of a.m., f.m. and combined a.m. and f.m. are studied. Computations of the frequency spectra for typical cases are made and compared with actual spectra obtained by means of a spectrum analyser.

621.396.619.11 **3701**

Overmodulation Splatter Suppression.—O. G. Villard, Jr. (*QST*, June 1947, Vol. 31, No. 6, pp. 13–20.) A method of filling in the overmodulation gaps in the carrier and so preventing the generation of spurious sidebands.

621.396.619.15 : 621.396.3 **3702**

Relative Amplitude of Side Frequencies in On-Off and Frequency-Shift Telegraph Keying.—G. S. Wickizer. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 158–168.) Measurements and calculations on the frequency spread of the sidebands indicate that frequency-shift keying requires less bandwidth than on-off keying as the characters may be shaped by a low-pass filter.

621.396.619.23 **3703**

A 40-Watt Modulator with Cathode-Coupled Driver.—W. J. Lattin. (*QST*, April 1947, Vol. 31, No. 4, pp. 42–44.) Circuit details of a unit with built-in power supply and four stages terminating in a 6L6G push-pull class AB2 output stage.

621.396.645 **3704**

Design of Linear Amplifiers for Single Side Band Transmitters.—E. Green. (*Marconi Rev.*, Jan./March 1947, Vol. 10, No. 84, pp. 11–16.) Distortion of a modulated carrier in a transmitter due to varying input impedance of the power amplifier is avoided by using screen-grid driving valves with an impedance transforming network.

621.396.65.029.63 **3705**

An Experimental Transmitter for Ultra-Short-Wave Radio-Telephony with Frequency Modulation.—A. van Weel. (*Philips tech. Rev.*, April 1946, Vol. 8, No. 4, pp. 121–128.) For another account see 2606 of August.

VALVES AND THERMIONICS

621.314.6.032.212 **3706**

A Cold Cathode Rectifier.—W. H. Bennett. (*J. appl. Phys.*, May 1947, Vol. 18, No. 5, pp. 479–482.) Corona discharge is used at atmospheric and higher pressures in H and N free from electron-attaching impurities. Such rectifiers have definite advantages where current requirements are small.

621.314.67 **3707**

Determination of Current and Dissipation Values for High-Vacuum Rectifier Tubes.—A. P. Kauzmann. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 82–97.) "Rectifier data are shown graphically with generalized parameters from which it is possible to determine the peak steady-state current, the maximum possible hot-switching current, and the dissipations in the diode and in any added series resistors. The paper covers capacitive-input filters with large capacitors and includes half-wave, full-wave, and voltage-doubler circuits. A table of operating conditions and efficiency for a group of typical rectifiers is included."

621.314.671 : 621.386.1 : 616-073.75 **3708**

High-Voltage Rectifier Valves for X-Ray Diagnostics.—J. H. van der Tuuk. (*Philips tech. Rev.*, July 1946, Vol. 8, No. 7, pp. 199–205.) Relative merits of gas-filled and vacuum valves and construction of new vacuum valves with thoriated tungsten cathodes.

621.383.4 : 535.215 **3709**

Lead Sulphide Photoconductive Cells.—L. Sosnowski, J. Starkiewicz & O. Simpson. (*Nature, Lond.*, 14th June 1947, Vol. 159, No. 4050, pp. 818–819.) The method of production developed at the Admiralty Research Laboratory is described in detail. Maximum sensitivity is assured when both lead and oxygen impurity centres are present in sufficient quantity and with relative concentration such that minimum conductivity and zero thermoelectric power are obtained. Theory is presented which is in general quantitative agreement with experiment as regards sensitivity, rectifying effect and time of response.

621.383.5 **3710**

Fatigue in Selenium Barrier Layer Photocells.—R. A. Houstoun. (*Phil. Mag.*, Jan. 1946, Vol. 37, No. 264, pp. 13–17.) See also 3433 of 1941.

621.385+621.396.694 **3711**

Tube Registry.—(*Electronics*, June 1947, Vol. 20, No. 6, pp. 244, 247.) Characteristics of iconoscope Type 5527, triode power amplifiers and oscillators Types 195 and 196 and c.r. tube Type 3MP1. See also 2976 of September and 2288 of July.

621.385 : 518.5 **3712**

Electrostatic Storage.—J. Rajachman. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 61.) Summary of I.R.E. paper. Describes a vacuum-tube 'memory' for electronic computers. A multi-cellular anode stores up to 4 096 impulses separately. Storing time is indefinite and reading follows the reading call by only a few microseconds and can be repeated indefinitely.

621.385 : 537.533.8 **3713**

Transit-Angle Suppression in Microwave Tubes.—J. H. Owen Harries. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 132–134.) Details of research into the control of the phase of the u.h.f. field near copper target anodes, for the suppression of secondary emission. A transverse modulated electron beam was passed through the aperture in a sub-anode, then traversed a distance d to the surface of the target anode. A resonant cavity in the output circuit was tuned to the modulation frequency f and power transfer was recorded by a diode. The transit angle $\phi = 10^3 d\pi/\lambda V_b^{\frac{1}{2}}$, where V_b is the target and sub-anode voltage and λ is the wavelength corresponding to f, was varied by altering d and/or V_b. Tests were carried out for λ 40 cm. Three types of copper target were used : (*a*) polished, (*b*) roughened and carbonized, (*c*) slotted and carbonized. Plots of ϕ versus power output efficiency show the slotted targets to be the most efficient, with values comparable with theory for $\phi > 0.3\pi$. The theory of suppression is illustrated by graphs in which the target and sub-anode currents are plotted against ωt for values of ϕ from $\pi/6$ to π.

621.385.029.63/.64]+621.396.615.14 **3714**

On Some Modern Constructions and Some Recent Designs of Ultra-Short-Wave Receiving and Transmitting Valves.—R. Warnecke. (*Bull. Soc. franç. Élect.*, Feb. 1947, Vol. 7, No. 66, pp. 81–94.) Technical details obtained by the author, during visits to Britain and the U.S.A., of the resnatron, klystrons and other high-power velocity-modulation valves, and travelling-wave valves. The prionotron designed by the author is also described.

621.385.029.63/.64 **3715**

Helical-Wave Properties.—C. C. Cutler. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 56.) Summary of I.R.E. paper. Probe measurements in a travelling-wave valve show that the longitudinal field component along the axis is greater than that predicted by theory.

621.385.029.63/.64 : [621.392 + 537.291 **3716**

On the Theory of Progressive-Wave Amplifiers.—Blanc-Lapierre, Lapostolle, Voge & Wallauschek. (*See* 3421.)

621.385.1 + 621.396.694 **3717**

A New Range of Glass-Based Valves.—(*Electronic Engng*, July 1947, Vol. 19, No. 233, p. 231.) Type numbers and brief descriptions are given of the new spigotless miniature valves with B8A base. The heater current in the a.c./d.c. range is 0.1 A and the bulb size approximately 20 mm. An a.c. range with the B8A base and 6.3 V heaters is also to be introduced, together with a high-gain screened h.f. pentode and a triode specially designed for television reception. Location of these valves in their holders is effected by a small boss on the side of the base.

621.385.1 + 621.396.694] : 389.6 **3718**

B8A Valve Base.—(*Electronic Engng*, July 1947, Vol. 19, No. 233, p. 235.) For details of the base, see 957 and 980 of March. A spigotless version is here announced, the ultimate aim being to standardize a range of valves to fit both bases.

621.385.1 **3719**

The Control of the Current Distribution in Electron Tubes.—J. L. H. Jonker. (*Philips Res. Rep.*, Nov. 1946, Vol. 1, No. 5, pp. 331–338.) Characteristics for control by a negative grid are calculated and shown to agree with experiment.

621.385.1 **3720**

Miniature Tubes in War and Peace.—N. H. Green. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 331–341.) " . . . describes the design features which account for the versatility and lower cost of the miniature tube and cites several varied applications of miniatures in both military and commercial equipment. A table showing typical present-day applications for miniature tubes is included."

621.385.1 : 621.396.694.012.8 **3721**

Valve Equivalent Circuit.—A. W. Keen : B. Salzberg. (*Wireless Engr*, July 1947, Vol. 24, No. 286, pp. 217–218.) The use of ' equivalent ' circuits with a voltage or a current generator is optional and a matter of convenience for external performance, but in general neither gives the correct value of internal power dissipation. See also 2622 of August (Salzberg) and back references.

621.385.2 : 621.396.822.029.6 **3722**

A Coaxial-Line Diode Noise Source for U.H.F.—H. Johnson. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 169–185.) The diode has a single-turn helical filament coaxial with, and connected to the inner conductor, the outer conductor being the anode. The valve is connected on one side to a lossy line to give the correct impedance load and on the other side to the 50-Ω input line of the receiver under test. A diode current of 100 mA may be obtained corresponding to a noise factor of 20 db. The effect of the filament capacitance in producing standing wave errors is considered and the transit-time loss is calculated and is shown to be about 3 db at 3 000 Mc/s. A comparison with signal generator measurement at 750 and 1 500 Mc/s gave a maximum discrepancy of 0.4 db.

621.385.2.032.216 **3723**

Effect of the Saturation Current on the Space-Charge Current in Valves using Oxide Cathodes.—R. Champeix. (*C. R. Acad. Sci., Paris*, 9th June 1947, Vol. 224, No. 23, pp. 1626–1628.) In a diode with oxide cathode the space-charge current may increase, remain unchanged, or sometimes even decrease when the saturation current increases. These anomalous results are explained.

621.385.3/5 : 621.317.336.1 **3724**

The Measurement of Dynamic Mutual Conductance of Valves using the Grounded-Grid Triode Mode of Operation.—Gutmann. (*See* 3576.)

621.385.4.029.63 **3725**

Tetrodes vs Triodes.—W. G. Wagener. (*Tele-Tech*, May 1947, Vol. 6, No. 5, p. 54.) Summary of I.R.E. paper. Neutralized tetrodes offer higher gain and greater circuit stability than neutralized triodes in the region of 500 Mc/s.

621.385.831 : 621.317.382 **3726**

Power Measurement of Class B Audio Amplifier Tubes.—Heacock. (*See* 3578.)

621.396.615.14 **3727**

The Excitation of Resonant Circuits by Electron Currents in the Transit-Time Domain.—Gundlach. (*See* 3468.)

621.396.615.141.2.032.21 **3728**

Coaxial Tantalum Cylinder Cathode for Continuous-Wave Magnetrons.—R. L. Jepsen. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 301–311.) The use of a cathode with a tungsten inner and tantalum outer conductor eliminates many of the drawbacks of normal cathodes.

621.396.615.141.2 **3729**

On Electron Oscillations in a Magnetron.—V. I. Kalinin & I. I. Wassermann. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 103–110. In Russian.) The electron oscillations in a split-anode magnetron are studied from the standpoint of spatial irregularities in the electron beam. The oscillations of the first order, which appear in all magnetrons under conditions close to the critical régime, are due to a certain radial irregularity. These conditions can be reduced to a system with a retarding field. In considering oscillations in a split-anode magnetron a conception of a tangential irregularity which takes place in the ' ring current ' in close proximity to the anode, is introduced and the frequency of the oscillations determined. Results of experiments with multi-segment magnetrons (from 4 to 20 segments) are in satisfactory agreement with the theoretical conclusions. For ' ring current ' see 64 of 1937 (Möller).

621.396.615.141.2 **3730**

A Frequency-Modulated Magnetron for Super-High Frequencies.—G. R. Kilgore, C. I. Shulman & J. Kurshan. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 657–664.) The development of a 25-W 4 000-Mc/s c.w. magnetron capable of a frequency deviation of 2.5 Mc/s without a.m. is described. F.m. is accomplished by the introduction of electron beams in two of the twelve cavities (3699 above). Design details and performance data are given.

621.396.615.141.2 **3731**
A 1-Kilowatt Frequency-Modulated Magnetron for 900 Megacycles.—J. S. Donal, Jr, R. R. Bush, C. L. Cuccia & H. R. Hegbar. (*Proc. Inst. Radio Engrs, W. & E.*, July 1947, Vol. 35, No. 7, pp. 664–669.) The design and performance of the magnetron are described. F.m. is accomplished by the introduction of electron beams in nine of the twelve cavities (3699 above) and a deviation of 3.5 Mc/s is obtained.

621.396.615.141.2 : 513.732.6 **3732**
A Flux Plotting Method for obtaining Fields satisfying Maxwell's Equations, with Applications to the Magnetron.—Crout. (*See* 3560.)

621.396.615.141.2 : 537.533.8 **3733**
The Secondary Emission in Magnetron Oscillators.—S. Ya. Braude & I. E. Ostrovski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 65–73. In Russian.) It has been observed that under certain conditions the anode current of a magnetron with grid control can be from 5 to 7 times the normal. A detailed investigation, both theoretical and experimental, shows that this phenomenon is due not to the ionization of the residual gases in the magnetron, as was supposed by some investigators, but to secondary emission from the grid of electrons travelling in the grid-anode space. It is also shown that the grid secondary emission can be greatly increased if oscillating potentials are present in the magnetron.

621.396.615.141.2 : 621.316.726 **3734**
Frequency Modulation and Control by Electron Beams.—Smith & Shulman. (*See* 3699.)

621.396.615.141.2 : 621.365.92 **3735**
A Magnetron Oscillator for Dielectric Heating.—R. B. Nelson. (*J. appl. Phys.*, April 1947, Vol. 18, No. 4, pp. 356–361.) Design and performance of a magnetron having 5 kW continuous output at 1 050 Mc/s.

621.396.615.141.2 : 621.396.933.2 **3736**
Stabilized Magnetron for Beacon Service : Part 1 — Development of Unstabilized Tube.—J. S. Donal, Jr, C. L. Cuccia & B. B. Brown. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 352–361.) The design of the valve is unconventional inasmuch as all the parts are supported on a header to which the envelope is welded. The inserts in the magnetic circuit are at cathode potential. The valve is designed for a pulsed input power of 2.5 kW. The unstabilized peak output is approximately 1 kW at 2 500 V anode potential and a frequency of 9 310 Mc/s.

621.396.615.141.2 : 621.396.933.2 **3737**
Stabilized Magnetron for Beacon Service : Part 2 — Engineering of Tube and Stabilizer.—C. P. Vogel & W. J. Dodds. (*RCA Rev.*, June 1947, Vol. 8, No. 2, pp. 361–372.) The frequency-stabilization device includes an invar tunable cavity using a plunger supported by a spindle of higher-expansion steel and is filled with dry nitrogen. The waveguide coupling to the load contains adjustable screw tuners. The stabilization process consists in the proper adjustment of these screws. The stability is improved by a factor of 10. For part 1 see 3736 above.

621.396.615.142 **3738**
The Principles of a General Theory of the Generation of Electron Oscillations at Ultra High Frequencies.—Kalinin. (*See* 3470.)

621.396.615.142.2 **3739**
The Theory of a Single-Circuit Klystron.—L. N. Loshakov & S. D. Gvozdover. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 79–86. In Russian.) In a reflex klystron the buncher and collector voltages coincide, with the result that its efficiency is lower than that of a klystron using two coupled resonators. To simplify the construction of the latter type, a klystron using a single resonator but with separate buncher and collector voltages is proposed (Fig. 1). An approximate theory of this klystron is given together with some preliminary experimental results.

621.396.615.142.2 **3740**
The Self-Excitation of a Reflex Klystron.—S. D. Gvozdover. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 75–78. In Russian.) The theory of the reflex klystron is discussed and the condition (5) necessary for self-excitation is established for the case when the potential of the reflecting electrode is equal to that of the cathode. Equation (6) determining the frequency of self-oscillations is also obtained.

621.396.615.142.2 : 621.396.645.029.64 **3741**
On U.H.F. Amplification and on the Resonance Method for suppressing Noise in a Klystron.—Katsman. (*See* 3481).

MISCELLANEOUS

061.6"1947"I.R.E. : 621.396 **3742**
I.R.E. reveals Engineering Advances.—(*Tele-Tech*, May 1947, Vol. 6, No. 5, pp. 52–61.) A report on the 1947 I.R.E. National Convention, with abstracts of 43 of the 125 technical addresses presented. For abstracts of selected individual papers, see other sections.

061.6(73) **3743**
Science Advancing — The Future of Testing.—E. U. Condon. (*ASTM Bull.*, May 1947, No. 146, pp. 53–58.) A review of some of the wartime activities of the National Bureau of Standards and brief discussion of future developments.

621.3 **3744**
British Industries Fair.—(*Elect. Rev., Lond.*, 2nd May 1947, Vol. 140, No. 3623, pp. 697–721.) A guide to the electrical exhibits at Castle Bromwich, Birmingham, and Olympia and Earls Court, London.

621.38/.39 + 539.17 **3745**
Nucleonics and Electronics.—K. Henney. (*Electronics*, June 1947, Vol. 20, No. 6, pp. 80–81.) Nucleonics, a generic name for atomic energy and related subjects and intimately related to electronics.

621.385.1 + 621.396.694] : 389.6 **3746**
B8A Valve Base.—(*See* 3718.)

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **3747**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 706–713.) See also 2306 of August.

534 **3748**

Program of the Thirty-Third Meeting of the Acoustical Society of America.—(*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 722–738.) Titles and abstracts of 78 papers, with author index.

534.231.3 **3749**

Acoustical Impedance of Enclosures.—F. B. Daniels. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 569–571.) Formulae are derived for the acoustical impedance of three types of enclosures: a sphere, a cylinder and a narrow rectangular box. The solutions are valid throughout the entire range from adiabatic to isothermal conditions.

534.232 : 621.396.67 **3750**

On the Radiation Problem [of a vibrating cylinder] **at High Frequencies.**—L. Lax & H. Feshbach. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 682–690.) The polar diagram and impedance of an acoustically-vibrating cylinder of arbitrary cross-section, large compared with the wavelength, are considered for various pressure and velocity distributions. Rapidly converging series solutions are obtained to an integral equation. The method has applications to radiation from electromagnetic shells whose surface distributions are specified.

534.24 : 551.510.52 **3751**

Reflection of Sound Signals in the Troposphere.—G. W. Gilman, H. B. Coxhead & F. H. Willis. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 390.) Summary of 330 of February.

534.321.9 **3752**

Ultrasonic Absorption [in liquids] **from 75 to 280 Mc/s.**—R. A. Rapuano. (*Phys. Rev.*, 1st July 1947, Vol. 72, No. 1, pp. 78–79.) A preliminary report. The pulse-echo method has been adapted by the use of an acoustic delay line consisting of a rod of fused quartz with polished parallel end faces.

534.321.9 **3753**

Ultrasonic Absorption in Liquids from 100 to 225 Mc/s.—R. A. Rapuano. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 184.) Summary of Amer. Phys. Soc. paper. Description of apparatus for examining the frequency dependence of the absorption, in order to investigate relaxation processes. Results for water are given.

534.321.9 **3754**

Ultra-Sound Waves made Visible.—G. W. Willard. (*Bell Lab. Rec.*, May 1947, Vol. 25, No. 5, pp. 194–200.) Supersonic waves in a liquid give a closely spaced system of compression and rarefaction regions with different optical refractive indices. Such a system behaves like an optical line grating, so that diffraction effects are obtained when a beam of light is passed at right angles through the supersonic beam in the liquid. Photographs exhibit many points of resemblance between supersonic and optical beams.

534.321.9 : 546.49 **3755**

Propagation of U.H.F. Sound in Mercury.—G. R. Ringo, J. W. Fitzgerald & B. G. Hurdle. (*Phys. Rev.*, 1st July 1947, Vol. 72, No. 1, pp. 87–88.) An outline of experiments in the frequency band 100–1 000 Mc/s. The results are compared with measurements made at lower frequencies by other experimenters. No significant change with frequency was observed in the speed of propagation or in the 'frequency-free' absorption coefficient.

534.321.9.001.8 **3756**

Opportunities in Ultrasonics.—S. Y. White. (*Audio Engng*, June 1947, Vol. 31, No. 5, pp. 30–32, 47.) Possible industrial applications of ultrasonic mechanical vibrations are briefly considered.

534.321.9.001.8 : 621.396.611.21 **3757**

Laboratory Supersonic Generators and Their Applications.—H. Tscherning. (*Rev. gén. Élect.*, Aug. 1947, Vol. 56, No. 8, pp. 319–327.) The principles of piezoelectric oscillators are briefly discussed and descriptions are given of practical apparatus of the piezoelectric and of the magnetostriction type suitable for the production of supersonic waves in liquids. Applications include the preparation of emulsions, many chemical and metallurgical processes, biological effects and the measurement of Young's modulus in metal rods.

534.417 : 534.88 **3758**

The German Use of Sonic Listening.—L. E. Holt. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 678–681.) "The most successful German sonic listening device, the GHG Gruppen Horch Gerät, is described in general terms. Reference is made to the types of ships using the equipment and to the arrangement and placement of the hydrophone arrays. A brief account is given of the steps taken by the Germans to improve the operation of the GHG by streamlining the array and by altering its position on the hull. The simple but efficient electrical training device is explained, and bearing accuracy and range data, as reported by the Germans, are presented. The paper is based on technical reports received from Germany and on subsequent investigations. The most important of the sources consulted is the Navy Technical Mission Report prepared by Mr. Laurence Batchelder."

534.43 : 621.395.61 **3759**

Moving Iron Pickups.—E. H. Francis. (*Wireless World*, Aug. 1947, Vol. 53, No. 8, pp. 285–286.) General discussion with special reference to the effect of inductance on frequency response, the impedance/frequency characteristic and frequency correction. A suggested preamplifier circuit with frequency correction is given.

534.43 : 621.395.67 **3760**

Transition Frequency Compensation.—C. G. McProud. (*Audio Engng*, July 1947, Vol. 31, No. 6, pp. 10–11.) RC equalizing networks compensate for recording loss which occurs at frequencies below 300, 500 or 800 c/s on various manufacturers' records. Networks are given for crystal and magnetic pickups.

534.771 **3761**

A Pulse-Tone Technique for Clinical Audiometric Threshold Measurements.—M. B. Gardner. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 592–599.) Description of a portable version of the equipment used for testing over 1 000 000 people at the 1939–40 World Fair in America (1403 of 1941). Operators and subjects both prefer the pulse-time to the standard manually interrupted tone method.

534.771 **3762**

Auditory Thresholds of Short Tones as a Function of Repetition Rates.—W. R. Garner. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 600–608.)

534.833.4 **3763**

Acoustical Properties of Homogeneous, Isotropic Rigid Tiles and Flexible Blankets.—L. L. Beranek. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 556–568.)

534.843 **3764**

The Effect of Non-Uniform Wall Distributions of Absorbing Material on the Acoustics of Rooms.—H. Feshbach & C. M. Harris. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, pp. 389–390.) Summary of 342 of February.

534.86 : 534.322.1 **3765**

Frequency Range Preference for Speech and Music.—H. F. Olson. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 549–555.) Tests with an acoustical 5 000-c/s low-pass filter placed between a light orchestra and the audience indicated that the full frequency range was preferred. The tests are part of a series designed to find out why most listeners prefer a restricted frequency range in monaural reproduced speech and music.

534.861.1 **3766**

The Acoustical Planning of Broadcasting Studios.—J. McLaren. (*B.B.C. Quart.*, Jan. 1947, Vol. 1, No. 4, pp. 194–208.) A brief survey of the basic problems of sound insulation and correction. Successful B.B.C. wartime improvisations are indicated. Acoustical correction experiments and methods are described. In particular, a pulse technique analogous to radar can be used for investigating the acoustic properties of large buildings.

621.395.61 : 534.6 **3767**

Application of the Methods of Automatic Regulation to Electroacoustic Apparatus. Method of obtaining the Response Curves of Microphones.—A. Moles. (*Onde élect.*, July 1947, Vol. 27, No. 244, pp. 276–283.) Methods similar to the automatic gain control used in radio circuits can be applied to a microphone preamplifier to obtain a correction of the amplification proportional to the instantaneous value of the sound field. The correcting voltage may be derived from a standard microphone with uniform response characteristics. Details are given of a method for the direct recording of microphone or loudspeaker response curves, including particulars of the automatic regulation of the output of the sound source used. See also 1306 of May.

621.395.61/.62].089.6 : 534.417 **3768**

The Practical Application of the Reciprocity Theorem in the Calibration of Underwater Sound Transducers.—P. Ebaugh & R. E. Mueser. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, Part 1, pp. 695–700.)

621.395.623 : 534.6 **3769**

Experiments on Artificial Ears.—I. Barducci. (*Alta Frequenza*, June/Aug. 1947, Vol. 16, Nos. 3/4, pp. 132–146. In Italian, with English, French and German summaries.) Determination of the dependence of the response curve of telephone receivers on cavity volume, coupling conditions and shape. Discussion of the results shows that it is possible to calculate the acoustic parameters of a telephone receiver and an artificial ear from the geometrical and physical data of the system.

621.395.623.7 **3770**

The Distribution of Acoustic Power.—L. Chrétien. (*T.S.F. pour Tous*, June 1947, Vol. 23, No. 224, pp. 137–138.) Various circuits for feeding loudspeakers. Continuation of 2317 of August.

621.395.625 **3771**

The Recording and Reproduction of Sound: Parts 1-4.—O. Read. (*Radio News*, March–June 1947, Vol. 37, Nos. 3–6, pp. 52–54, 50–52..153, 61–63..108 & 65–67..126.) The history, development and applications of all currently known methods. Descriptions are given of (*a*) lateral disk recording, (*b*) basic methods for embossing sound on film or disk, (*c*) magnetic recording on tape, disk or wire, (*d*) optical film recording and (*e*) magnetic cutters for home recording and for high-fidelity broadcast transcribing. Parts 5–7, 3772 below.

621.395.625 **3772**

The Recording and Reproduction of Sound: Parts 5-7.—O. Read. (*Radio News*, July–Sept. 1947, Vol. 38, Nos. 1–3, pp. 55–57..135, 57–59..148 & 62–64..147.) Description of the crystal cutter and its use for constant-amplitude and constant-velocity recording, various methods of magnetic recording on wire, tape, and magnetically coated materials, and various types of microphone used in recording. For parts 1–4 see 3771 above. To be continued.

621.395.625.3 : 621.396.97 **3773**

Adapting Paper Tape Recorders for Broadcasting.—R. S. O'Brien. (*Audio Engng*, June 1947, Vol. 31, No. 5, pp. 10–14, 48.)

621.395.667 **3774**

Response Equalization.—J. W. Straede. (*Radio Craft*, Sept. 1947, Vol. 18, No. 12, pp. 34–35, 77.) A simple system in which the bass attenuation may start at any of 5 (or more) frequencies, or the lower frequencies may be either kept constant or boosted. Similar arrangements can be made for the high frequencies.

621.395.92 **3775**

Hearing Aid Miniature.—(*Wireless World*, June 1947, Vol. 53, No. 6, p. 229.) The Multitone Type MT3 is a deaf aid with a built-in crystal microphone. The unit is $3\frac{1}{4}$ inches × $1\frac{11}{16}$ inches × $\frac{1}{2}$ inch and with the lightest of a range of battery packs weighs $6\frac{1}{2}$ oz.

AERIALS AND TRANSMISSION LINES

621.315.1 : 621.3.015.3 **3776**

Theory of the Propagation of Surge Waves on Two Parallel Lines.—M. Cotte. (*Rev. gén. Élect.*, Aug. 1947, Vol. 56, No. 8, pp. 343–352.) Theory is given for the case of lines without resistance and with considerable coupling. On the induced line it is shown that two voltage waves without current and two current waves without voltage may be propagated. The experimental results obtained by Mauduit (3777 below) and Rogowski with surge waves are explained with the aid of symbolic calculus.

621.315.1 : 621.3.015.3 : 621.317.755 **3777**

Oscillographic Study of Surge Waves and Oscillations in an Experimental Overhead Line.—A. Mauduit. (*Rev. gén. Élect.*, Aug. 1947, Vol. 56, No. 8, pp. 331–343.) A surge wave, started by a capacitor discharge at one end of an aerial line whose other end is open, is successively reflected at the two ends and gives rise to a stationary damped oscillation, the line vibrating as a quarter-wave line. The damping obtained with various line terminations, and with return by earth or a parallel wire, is considered. When the far end is earthed through a resistance equal to the characteristic impedance Z of the line, there is no reflection and the surge wave dies away without oscillation, but a wave can be induced in a parallel return line. The cases in which this line is open at both ends or is earthed at the origin are considered. A remarkable result is that if the parallel return line is earthed at the origin through an impedance nearly equal to Z, no wave is induced in the parallel line by a surge wave in the original line.

621.315.21 : 621.395.822.1 **3778**

Splicing of Cables with Systematic Permutation.—G. Chardon. (*Câbles & Transmission, Paris*, April 1947, Vol. 1, No. 1, pp. 77–86. With English summary.)

621.315.21.011.2 **3779**

Maximum Tolerable Impedance Deviations in Repeatered Cable Sections.—R. Belus, P. Herreng & J. Ville. (*Câbles & Transmission, Paris*, April 1947, Vol. 1, No. 1, pp. 3–12. With English summary.) Discussion of the conditions to be fulfilled by mean-square values of impedance deviations of individual cable lengths, a number of which are connected in series between two successive repeaters.

621.315.212 + 621.392.029.64 **3780**

Transmission of Electromagnetic Guided Waves through a Series of Symmetrical and Equidistant Obstacles.—J. Lévy. (*Câbles & Transmission, Paris*, July 1947, Vol. 1, No. 2, pp. 103–113. With English summary.) When a waveguide or concentric cable has obstacles uniformly distributed along it, its transmission properties cease to vary uniformly with the frequency as soon as the distance between consecutive obstacles is comparable with the wavelength. When the number of obstacles is great enough, the cable or guide acquires the properties of a multiple band filter. Methods of calculating the limits of the pass and attenuating bands are given and applied to the case of a coaxial cable with a series of evenly distributed insulating disks.

621.315.212.029.6 : [621.317.333 + 621.317.37 **3781**

The Voltage Characteristics of Polythene Cables.—R. Davis, A. E. W. Austen & W. Jackson. (*J. Instn elect. Engrs*, Part I, June 1947, Vol. 94, No. 78, pp. 283–284.) Summary of 3179 of October.

621.315.212.011.2 **3782**

Note on the Statistical Study of Impedance Irregularities in Coaxial Pairs.—G. Fuchs. (*Câbles & Transmission, Paris*, April 1947, Vol. 1, No. 1, pp. 13–30. With English summary.) Previous mathematical results are reviewed and new statistical relations are established. A detailed study is made of the distribution of zeros and maxima or minima of the impedance-deviation curve as a function of the frequency interval between two successive measurements. Calculated and experimental results are in good agreement.

621.392 **3783**

Power Reflection.—P. M. Prache. (*Câbles & Transmission, Paris,* April 1947, Vol. 1, No. 1, pp. 31–37. With English summary.) The transmitted and reflected powers at an interconnection point between a generator or a transmission line and a receiving impedance are calculated as functions of the power which would theoretically be transmitted at the same point to an impedance equal to the characteristic impedance. A coefficient of reflection of available power is defined as the ratio of the power actually reflected to the maximum power obtainable from the source. This coefficient remains unaltered when a non-dissipative quadripole is interposed.

621.392.029.64 **3784**

Receiving Vibrator in a Waveguide.—I. I. Volman. (*Radiotekhnika, Moscow,* Jan. 1947, Vol. 2, No. 1, pp. 27–35. In Russian with English summary.) The vibrator input resistance is computed taking account of the reflections at the load terminating the waveguide. The s.w.r. as well as the position of the electric field nodes relative to the receiving vibrator, arbitrarily loaded, are determined.

621.392.029.64 **3785**

The Effects of Curvature and Curvature Discontinuities on Wave Propagation in Guides of Rectangular Cross-Section.—M. Jouguet. (*Câbles & Transmission, Paris,* April 1947, Vol. 1, No. 1, pp. 39–60. With English summary.) A full mathematical treatment of the subject. Some of the results obtained have been reported previously in short non-mathematical papers. See also 1667 and 1668 of June and back references.

621.392.029.64 **3786**

The Effects of Curvature on the Propagation of Electromagnetic Waves in Guides of Circular Cross-Section.—M. Jouguet. (*Câbles & Transmission, Paris,* July 1947, Vol. 1, No. 2, pp. 133–153. With English summary.) A complete account of the work already noted in 2669 of September and back references.

621.392.029.64 : 534.11 **3787**

A Mechanical Analogy for Transverse Electric Waves in a Guide of Rectangular Section.—Makinson. (*See* 3844.)

621.392.029.64 : 621.317.3 **3788**

Definition and Measurement of the Coefficient of Reflection in Waveguides.—J. Ortusi. (*Ann. Radioélect.,* April 1947, Vol. 2, No. 8, pp. 173–194.) Definitions are given, for a type of guided wave, of the coefficients of reflection and transmission and of the apparent impedance. Two methods of measuring reflection coefficients are fully described, the first a direct method and the second a very accurate zero method. The results obtained are in perfect agreement with theory.

621.392.029.64 : 621.317.3 **3789**

Experimental Determination of Input Resistances of Vibrator in a Rectangular Waveguide.—I. I. Volman & A. I. Shpuntov. (*Radiotekhnika, Moscow,* Jan. 1947, Vol. 2, No. 1, pp. 36–48. In Russian with English summary.) Comparison of the experimental results with theory shows that the current distribution along the vibrator is not sinusoidal. The results support theoretical conclusions as to the effect of waveguide walls and of reflections at the terminating load.

621.392.2 : 621.315.212.2 **3790**

Concentric Line.—H. Bondi & S. Kuhn. (*Wireless Engr,* Aug. 1947, Vol. 24, No. 287, pp. 222–223.) Curves of critical wavelength and wave-impedance of $H_{n,1}$ modes in terms of the conductor diameters are given. The critical wavelength of the H_{11} mode is approximately equal to the mean of the circumferences of the inner and outer conductors.

3791

621.392.4.029.58 + 621.396.67.029.58] : 621.317.3

The Testing of High-Frequency Aerial Systems and Transmission Lines.—E. J. Wilkinson. (*Proc. Instn Radio Engrs, Aust.,* May 1947, Vol. 8, No. 5, pp. 17–18.) Comment on and amplification of 2672 of September.

621.392.43 **3792**

An Exponential Transmission Line employing Straight Conductors.—W. N. Christiansen. (*AWA tech. Rev.,* April 1947, Vol. 7, No. 3, pp. 229–240.) Reprint of 3023 of October.

621.392.43 **3793**

An Eight-Wire Transmission Line for Impedance-Transformation.—W. N. Christiansen & J. A. Guy. (*AWA tech. Rev.,* April 1947, Vol. 7, No. 3, pp. 241–249.) The characteristic impedance Z_0 of an 8-wire line comprising two identical 4-wire transmission lines arranged about a common axis is given by a simple expression involving cot θ, where θ is the angle through which one set of four wires is turned with respect to the other set. An approximately exponential variation of Z_0 can be obtained by varying θ and the wire spacing in linear steps. The design and construction of such a line transforming from 131 to 262 Ω is described. See also 3023 of October.

621.396.67 **3794**

The Radiation Patterns of Dielectric Rods — Experiment and Theory.—R. B. Watson & C. W. Horton. (*Phys. Rev.,* 15th July 1947, Vol. 72, No. 2, p. 159.) Summary of Amer. Phys. Soc. paper. The radiation pattern for a dielectric rod, obtained theoretically by considering an equivalent surface distribution of electric and magnetic currents, has been measured for polystyrene rods of rectangular cross-section and of length 3λ–10λ. The widths of the major lobes and the positions of the first two minor lobes agree well with theory for rod lengths up to 5λ, but the heights of the first minor lobes show poorer agreement.

621.396.67 : 534.232 **3795**

On the Radiation Problem [of a vibrating cylinder] **at High Frequencies.**—Lax & Feshbach. (*See* 3750.)

621.396.67 : 621.396.96 **3796**

Radar Antennas.—H. T. Friis & W. D. Lewis. (*Bell. Syst. tech. J.,* April 1947, Vol. 26, No. 2, pp. 219–317.) A comprehensive survey paper divided into three parts. Part 1 defines gain, effective area, free-space transmission loss, etc., and develops radiation-patterns of various basic ideal and amplitude-tapered apertures of uniform phase, large compared with the wavelength, by the Huyghens source method. The effects of square and cubic aperture phase variations, representing common practical illumination distortion, are also considered. Part 2 deals with methods of aerial construction ; possible methods are classified and basic designs formulated. Parabolic aerials, metal plate lenses, cosecant aerials, and lobing and scanning techniques are considered in some detail. Part 3 details shipborne, airborne and ground radar aerials developed by the Bell Laboratories.

621.396.67 : [621.396.97 + 621.397.5 **3797**

Triplex Antenna for Television and F.M.—L. J. Wolf. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 88–91.) Details of a single four-bay superturnstile aerial used for simultaneous operation of a f.m. transmitter and the visual and aural transmitters of a television station, with negligible coupling between transmitters. The power gain is 6.4 for f.m. and 5 for television.

621.396.67 : 621.396.97 **3798**

F.M. [broadcast] **Antenna uses Waveguide Principle.**—G. G. Greene. (*FM & Televis.*, July 1947, Vol. 7, No. 7, p. 38.) A new design requiring only two short waveguide sections arranged at right angles and fed 90° out of phase. High gain and freedom from icing are claimed.

621.396.67 : 621.397.5 **3799**

Television Aerials.—N. M. Best & R. D. Beebe. (*Wireless World*, Aug. 1947, Vol. 53, No. 8, pp. 293–295.) Design considerations are discussed in detail with special reference to the reflector array with $\lambda/8$ spacing. Curves indicate the comparison between $\lambda/4$ and $\lambda/8$ reflector spacing. The close-spaced array has a more even gain over the transmitting band and better signal/noise ratio in the sound channel.

621.396.671 **3800**

Partially-Screened Open Aerials.—A. Colino. (*Wireless Engr*, Aug. 1947, Vol. 24, No. 287, p. 248.) Comment on 2681 of September (Burgess).

621.396.671 : 621.317.79.083.7 **3801**

Theoretical and Experimental Study of a Feeder Reflectometer.—A. R. Volpert. (*Radiotekhnika, Moscow*, Feb. 1947, Vol. 2, No. 2, pp. 3–23. In Russian, with English summary.) Construction and operation of an instrument for remote measurement of the standing wave ratio in aerial feeders.

621.396.677 **3802**

Metal-Lens Antennas.—W. E. Kock. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 391.) Summary of 1013 of April.

CIRCUITS AND CIRCUIT ELEMENTS

621.318.371.011.2/.4 **3803**

Q of Solenoid Coils.—R. G. Medhurst. (*Wireless Engr*, Sept. 1947, Vol. 24, No. 288, p. 281.) Author's reply to comment on 1694 of June by Callendar (3046 of October).

621.318.572 **3804**

Scale of N Counting Circuits.—B. Howland. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 138..178.) A generalized Eccles-Jordan circuit having N states of stable equilibrium can be obtained by interconnecting N valves symmetrically so that conduction in one valve cuts off current in all the others. This can be done with multigrid valves since conduction in any one valve will make the voltage of one grid in each of the others negative. The small number of sensitive grids in most valves sets an upper limit to N.

A diode-triode circuit avoids this limitation but requires too many valves to be practical. A simplification requiring relatively few valves and interconnections is obtained if each valve, when conducting, cuts off two valves opposite it in the circuit.

Decade counters can best be constructed by combining scale-of-5 and scale-of-2 counters.

621.318.572 **3805**

A Fast Coincidence Circuit with Pulse Height Selection.—P. R. Bell, S. DeBenedetti & J. E. Francis, Jr. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 160.) Summary of Amer. Phys. Soc. paper. A system using two channels : a pulse height selector and a differentiation and delay circuit, so enabling simultaneous or delayed coincidences between pulses (within specified height limits) to be determined to about 0.3 μs.

621.318.572 **3806**

A Diode Coincidence Circuit.—J. D. Shipman, Jr., B. Howland & C. A. Schroeder. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 181.) Summary of Amer. Phys. Soc. paper.

621.318.572 **3807**

Frequency Meter for Random or Uniformly Spaced Pulses.—H. L. Schultz. (*Rev. sci. Instrum.*, April 1947, Vol. 18, No. 4, pp. 223–225.) An electronic instrument "capable of operating at random rates of about 5 000 pulses per second on the average with less than 2% error caused by resolving time." A resolving time in the vicinity of 1 μs can be achieved. Provision is made for the operation of a counter at low rates.

621.318.572 **3808**

Tone Burst Generator.—R. G. Roush. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 92–96.) Four single-cycle multivibrators controlled by a free-running multivibrator serve as an adjustable electronic switch. Two circuits can be switched at the same adjustable repetition rate but with independently controllable duration and spacing times.

621.319.4 **3809**

Capacitor Manufacture.—(*Elect. Rev., Lond.*, 30th May 1947, Vol. 140, No. 3627, pp. 911–912.) Use of pilot plant for small-scale manufacture of new types, to ensure the highest possible quality in quantity production.

621.319.4 **3810**

Hermetic Low-Voltage Paper Capacitors.—I. I. Morozov. (*Radiotekhnika, Moscow*, Feb. 1947, Vol. 2, No. 2, pp. 51–62. In Russian with English summary.) Various methods are described for vacuum-tight seals and the electrical characteristics are given for various types of liquid and solid impregnants. Aging effects are discussed and accelerated life tests are described.

621.319.4 : 621.315.614.6 **3811**

Paper Capacitors containing Chlorinated Impregnants — Effects of Sulfur.—D. A. McLean, L. Egerton & C. C. Houtz. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 392.) Summary of 655 of March. *Note.* U.D.C. of 655 should read as above.

621.38/.39] (084.2) **3812**

Graphical Symbols for Electronic Diagrams.—(*Electronics, Buyers' Guide Issue,* June 1947, Vol. 20, No. 6B, pp. 122–123.) A chart including new symbols proposed by the I.R.E.

621.392 **3813**

Response of Linear Resonant System to Excitation of a Frequency varying Linearly with Time.—G. Hok. (*Phys. Rev.,* 15th July 1947, Vol. 72, No. 2, p. 159.) Summary of Amer. Phys. Soc. paper. Calculation by means of Laplace transforms yields a result in terms of Fresnel integrals of a complex variable.

The significant parameter in the result is logarithmic decrement/(rate of change of frequency)$^{\frac{1}{2}}$.

621.392 : 517.93 **3814**

A Note on Van Der Pol's Equation.—N. G. de Bruijn. (*Philips Res. Rep.,* Dec. 1946, Vol. 1, No. 6, pp. 401–406.) A criticism and extension of Shohat's work (3656 of 1944). A new theorem concerning the analytical behaviour of periodic solutions of the equation is proved. It is shown that the agreement between Shohat's work and earlier experimental and theoretical results is accidental.

621.392.4 **3815**

Cathode Phase Inverter Design.—C. W. Vadersen. (*Audio Engng,* June & July 1947, Vol. 31, Nos. 5 & 6, pp. 18–19..47 & 20–22, 47.) An analysis of unbalance caused by variation of circuit parameters. Practical examples of the intermediate and output stages of the inverter are given.

621.392.41 : 621.395.623.7 **3816**

Design and Construction of Practical Dividing Networks.—C. G. McProud. (*Audio Engng,* June 1947, Vol. 31, No. 5, pp. 15–17..46.) Simple details for a particular type of loudspeaker dividing network.

621.392.5 **3817**

Study of the Properties of Quadripoles by Impulse Response. General Method for the Realization of Electric Filters. Filters with Linear or 90° Phase Shift.—M. Lévy. (*Onde élect.,* July 1947, Vol. 27, No. 244, pp. 261–275.) A function, termed the impulse response, which completely defines a quadripole, can be deduced from the reciprocal integrals of Fourier. It gives the quadripole response to a pulse of infinitely short duration ; the laws of variation with frequency of phase and of attenuation can be deduced from it, and conversely. A general study of this function is presented. In particular, if the impulse response has a vertical axis of symmetry, either the phase change of the quadripole is proportional to the frequency or the phase is equal to $\pi/2$ at all frequencies, according as the curve is even or odd with respect to this axis. From the fact that the impulse response can be produced by the addition of a multitude of reflections of the initial pulse in the quadripole, a general method is derived for the design of a quadripole having a pulse response of any form whatever. The theory is applied to the construction of filters ; a low-pass filter with rigorously linear phase shift is described which gives an attenuation of about 30 db in the pass band. The following types of filters producing a phase shift of 90° at all frequencies can be constructed : (*a*) high-pass filters with satisfactory characteristics up to frequencies 10 to 20 times the cut-off frequency ; (*b*) band-pass filters, if the bandwidth is not too small ; (*c*) low-pass filters, if the lower frequency limit to be transmitted is not too low.

621.392.52 **3818**

Extension of Norton's Method of Impedance Transformation to Band-Pass Filters.—V. Belevitch. (*Elect. Commun.,* March 1947, Vol. 24, No. 1, pp. 59–65.) Some applications of a method of network analysis first discovered by E. L. Norton (U.S. Patent 1 681 554), and sometimes used in the design of band-pass filters, are considered. Norton's method can be extended in different ways, and in certain cases indicates the design of new and more economical structures for composite band-pass filters.

621.392.52 **3819**

Filter Design Tables based on Preferred Numbers.—H. Jefferson. (*Wireless Engr,* Aug. 1947, Vol. 24, No. 287, pp. 242–245.) For the design of constant-*k* band-pass filters having preferred values of capacitance. See also 2503 or 1946 and back references.

621.392.52.011.2 **3820**

The Direct Setting-Up of $Z_{\alpha\beta}$ for Closed-Mesh Networks from the Network Diagram : Part 2.—S. A. Stigant. (*Beama J.,* Feb. 1947, Vol. 54, No. 116, pp. 65–69.) Branch current axes are considered. Rules are given for setting up $Z_{\alpha\beta}$ for loop and branch currents, with or without mutual impedance. For part 1 see 2033 of July.

621.392.6 **3821**

The Constants of a Passive Network.—P. Satche. (*Rev. gén. Élect.,* June 1947, Vol. 56, No. 6, pp. 267–270.) The inequality relations which should be satisfied by the constants of an *n*-pole passive network are established. The equation giving the active power of a passive network is put into a simple form and the inequalities existing between the real parts of the impedances of the network, measured between terminals, are determined. The analogy is demonstrated between this problem and that of the existence of a polyhedron of *n* vertices in a space of (*n*-1) dimensions.

621.396.611.39 **3822**

Link Coupling.—(*Wireless World,* Aug. 1947, Vol. 53, No. 8, pp. 291–292.) An equivalent circuit is derived and the formula for optimum coupling deduced. It is stressed that the correct method of adjusting the link coupling between two coils is by altering the physical separation at one end of the link rather than the number of turns at both ends.

621.396.611.4 **3823**

Graphical-Numerical Method for the Calculation of Resonator Cavities.—M. Abele. (*Alta Frequenza,* June/Aug. 1947, Vol. 16, Nos. 3/4, pp. 174–191. In Italian, with English, French and German summaries.) For cavities bounded by a surface of revolution, the method gives the configuration of the electric field and enables the fundamental resonance frequency and the damping factor to be calculated. Two examples are given: (*a*) a cylinder of circular cross-section, (*b*) two coaxial cylinders, the inner one being the shorter.

621.396.611.4 : 537.533 **3824**

Cavity Resonators and Electron Beams.—A. H. Beck : J. H. Owen Harries. (*Wireless Engr*, Sept. 1947, Vol. 24, No. 288, pp. 280–281.) Comment on 2706 of September (Owen Harries) and the author's reply.

621.396.615 **3825**

Amplitude Control in RC Oscillators.—E. J. B. Willey. (*Wireless World*, June 1947, Vol. 53, No. 6, pp. 219–220.) An alternative to the use of a non-linear lamp resistance, as proposed by Terman and others (64 of 1940) consists in balancing two negative feedback networks which vary the feedback in opposite senses with frequency.

621.396.615 **3826**

Principles of Addition of Powers in Valve Oscillators.—Z. I. Model. (*Radiotekhnika, Moscow*, Jan. 1947, Vol. 2, No. 1, pp. 3–26. In Russian, with English summary.)

621.396.615.029.5 **3827**

Improvements in the H.F. Beat-Frequency Oscillator.—R. Aschen & M. Lafargue. (*T.S.F. pour Tous*, June 1947, Vol. 23, No. 224, pp. 127–131.) These comprise (*a*) suppression of parasitic f.m. when using a.m., (*b*) introduction of a f.m. stage, (*c*) reduction of the harmonics of the fixed oscillator and (*d*) improved output arrangements. For a description of the oscillator see 2358 of August or 1709 of June.

621.396.615.12 **3828**

A Bandswitching V.F.O. Exciter.—C. Hays. (*Radio News*, Sept. 1947, Vol. 38, No. 3, pp. 49–51, 183.) Covers the 10-, 20-, 40- and 80-m bands and uses a two-section ceramic wafer type switch. Both sections are of the single-pole 4-position type; the output section is non-shorting.

621.396.615.17 : 621.317.755 : 621.396.96 **3829**

Radial Time Bases.—G. W. A. Dummer & E. Franklin. (*Wireless World*, Aug. 1947, Vol. 53, No. 8, pp. 287–290.) Wartime development of the p.p.i. is described in some detail. The circuit diagram of an early type of timebase for electrostatically deflected tubes is given, together with the voltage waveforms in each stage. Difficulties encountered in the production of timebases for electromagnetic tubes are discussed.

621.396.621.54 **3830**

Superheterodyne Tracking Charts: Part 5.—A. L. Green. (*AWA tech. Rev.*, April 1947, Vol. 7, No. 3, pp. 295–325.) Methods of simplifying the computation of superheterodyne tracking errors are described. Much of the required design data is presented in the form of tracking charts. For parts 1–4 see 3830 of 1945 and back references.

621.396.622.63 : [546.28+546.289 **3831**

Silicon and Germanium Rectifiers.—(*Electronics, Buyers' Guide Issue*, June 1947, Vol. 20, No. 6B, pp. 146–147.) Lists of available types, with details of all necessary design characteristics except linear dimensions.

621.396.645 : 518.3 **3832**

Cathode Follower Impedance Nomograph.—M. B. Kline. (*Electronics*, July 1947, Vol. 20, No. 7, p. 130.) Relates output impedance, transconductance, and cathode load resistance. See also 3455 of November and 2717 of September.

621.396.645 : 535.61-15 : 621.383.4 **3833**

Two Amplifiers for PbS Photo-Cells used in Recording Infra-Red Spectra.—W. R. Wilson. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 156.) Summary of Amer. Phys. Soc. paper. A method for providing good signal/noise ratio at slow scanning speeds by chopping the infra-red beam and also the light from a tungsten lamp and feeding the corresponding photocell outputs to a balanced modulator.

621.396.645 : 621.396.822 **3834**

Background Noise in Amplifiers.—W. Roos. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Aug. 1947, Vol. 25, No. 4, pp. 143–147. In German.) The various sources of noise in preamplifiers and power amplifiers are discussed and suggestions are made for noise reduction.

621.396.645.029.3 **3835**

High-Quality Audio Amplifier with Automatic Bias Control.—J. R. Edinger. (*Audio Engng*, June 1947, Vol. 31, No. 5, pp. 7–9, 41.) Exceptionally low distortion and uniform response from 20 to 20 000 c/s. Power triodes in push-pull, with automatic bias control, give an output of up to 30 W.

621.396.645.029.62 **3836**

A 15-W Amplifier for V.H.F.—L. Liot. (*Télévis. franç.*, Aug. 1947, No. 28, Supplement *Électronique*, pp. 29–32.) Circuit details of the voltage amplifier, frequency tripler and doubler stages and final power stage of apparatus covering the range 50–100 Mc/s, with input of 1 V from a master oscillator.

621.396.645.36 **3837**

Push-Pull Phase-Splitter.—E. Jeffery. (*Wireless World*, Aug. 1947, Vol. 53, No. 8, pp. 274–277.) A new high-gain circuit is described in which the high input impedance of a cathode follower is used as the anode load of the preceding a.f. stage. The circuit diagram is given of a complete 14.5-W amplifier with a measured response variation within ±1 db from 25 to 20 000 c/s.

621.396.662 **3838**

Attenuators with Linear Response.—C. Dreyfus-Pascal & R. Gondry. (*Toute la Radio*, June 1947, Vol. 14, No. 116, pp. 179–181.) Combinations of suitably chosen resistors and capacitors give an attenuator with response linear up to 1 Mc/s.

621.396.662.3 : [621.395.61 : 534.43 **3839**

Simple RC Filters for Phonograph Amplifiers.—G. L. Rogers. (*Audio Engng*, June 1947, Vol. 31, No. 5, pp. 28–29 . . 48.) Designed for improved reproduction with magnetic type pickups.

621.396.662.3.029.3 **3840**

Tuned A.F. Filters: Part 2.—H. E. Styles. (*Wireless World*, Aug. 1947, Vol. 53, No. 8, pp. 282–284.) Design of a correction filter for a crystal pickup. For part 1 see 3486 of November.

621.396.69 + 621.396.621 **3841**

Robot makes Radios.—Hallows. (*See* 4010.)

GENERAL PHYSICS

53.081 **3842**

On the Absolute Systems of Electrical Units.—É. Brylinski. (*Rev. gén. Élect.*, May 1947, Vol. 56, No. 5, pp. 235–236.) Discussion shows that certain systems, particularly that of Gauss, can be used with advantage in the domain of pure theory, but for practical purposes a system is required involving only four fundamental units. See also 2383 of August and 1392 of May (Dorgelo & Schouten).

530.12 : 538.3 **3843**

On the Kinematics of Uniformly Accelerated Motions and Classical Electromagnetic Theory.—E. L. Hill. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 143–149.) "A study is made of the 4-dimensional conformal group of transformations in space-time as the extension of the Lorentz group permitting the introduction of uniformly accelerated reference frames into relativity theory. The problem of the motion of a particle is discussed, as well as the implications for the classical-type electron theory developed by Dirac."

534.11 : 621.392.092.64 **3844**

A Mechanical Analogy for Transverse Electric Waves in a Guide of Rectangular Section.—R. E. B. Makinson. (*J. sci. Instrum.*, July 1947, Vol. 24, No. 7, pp. 189–190.) If a stretched rubber strip is clamped at the edges and excited transversely at one end, its vertical displacement and slope at any point correspond to the electric and magnetic vectors respectively. Such a model can be used to predict the effects of various waveguide configurations on H_{0m} waves.

535.338 **3845**

The Molecular Beam Magnetic Resonance Method. The Radiofrequency Spectra of Atoms and Molecules.—J. B. M. Kellogg & S. Millman. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 391.) Summary of 1731 of June.

535.343.31-31 : [546.212 + 546.212.02 **3846**

Inter-Molecular Vibration Spectrum of Water.—R. C. Johnson, R. C. Weidler & D. Williams. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 158.) Summary of Amer. Phys. Soc. paper. Studies of the spectra of liquid H_2O and D_2O between 1.5 μ and 24 μ. The observed absorption extends from 10 μ to 21 μ for H_2O, and from 12 μ to 22 μ for D_2O.

536.48 **3847**

Low-Temperature Physics and the Theory of Metals.—E. B. Mendoza. (*Metal Treatm.*, Spring 1947, Vol. 14, No. 49, pp. 20–28.) A description of the techniques used, including that for obtaining temperatures below 1°K by adiabatic demagnetization of a paramagnetic salt, together with an account of the impact of these techniques on the theory of atomic structure.

537.228.1 : 621.396.611.21 **3848**

Thermal Voltage of a Quartz Crystal.—R. K. Cook, M. Greenspan & P. G. Weissler. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 175.) Summary of Amer. Phys. Soc. paper. The mean-square noise voltage is given by C_1kT/C_0^2, where C_1 is the crystal capacitance and C_0 is the input capacitance of the amplifier plus the shunt capacitance of the crystal. The noise spectrum is concentrated in the region of the resonant frequency of the crystal. At 0.01°K the peak charge would be about 1 electron.

537.291 **3849**

Control of Electron-Beam Dispersion at High Vacuum by Ions.—L. M. Field, K. Spangenberg & R. Helm. (*Elect. Comm.*, March 1947, Vol. 24, No. 1, pp. 108–121.) Based on the book referred to in 4071 below. When a high-density electron beam is passed through a field-free drift space, a dispersion of the beam occurs at much higher gas pressures than was expected from previous theories. A new approximate theory of positive ion removal (i.e., from the beam) is given which has had considerable success in predicting the effects observed. Further, as a result of the new theory, an 'ion trap' has been invented which prevents such dispersion.

537.291 : 621.385.1.032.21 **3850**

Cathode-Design Procedure for Electron-Beam Tubes.—Helm, Spangenberg & Field. (*See* 4071.)

537.312.62 **3851**

The Practical Possibilities of Superconductivity.—K. M. Koch. (*Elektrotech. u. Maschinenb.*, July/Aug. 1947, Vol. 64, Nos. 7/8, pp. 125–130.) A review of present knowledge, including experimental results of many investigators, and a discussion of applications to magnetic screening, photocells and h.f. circuits. The importance of developing improved refrigeration technique is stressed. A new theory appears to be necessary to account for all the phenomena.

537.312.62 **3852**

The Magnetic Threshold Curves of Superconductors.—J. G. Daunt. (*Phys. Rev.*, 1st July 1947, Vol. 72, No. 1, pp. 89–90.) Discussion of experimental results favours the view that the threshold curves are approximately parabolic functions of temperature. The 3/2-power function suggested by Sienko and Ogg (*Phys. Rev.*, Vol. 71, p. 319) is not supported by known magnetic or calorimetric data.

537.312.62 : 621.396.622 **3853**

Radio Frequency Detection by Superconductivity.—D. H. Andrews & C. W. Clark. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 161.) Summary of Amer. Phys. Soc. paper. A r.f. voltage modulated at 400 c/s is detected by a strip of superconducting CbN. There are several temperature zones of detection which increase with applied d.c. but are independent of frequency. The intensity of detection varies widely with frequency.

537.5 **3854**

The Kelvin Lecture. Electrical Discharge through Gases.—L. B. Loeb. (*Electrician*, 2nd May 1947, Vol. 138, No. 3594, pp. 1162–1164.) A historical review of the subject.

537.523.3 **3855**

Notes on Impulse Corona Studies in Air.—H. J. Hall. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 185.) Summary of Amer. Phys. Soc. paper. Results obtained with positive and negative pulses up to 60 kV, of duration 1–2 μs and repetition rates 250–2 000 per sec.

537.525 : 621.385.18 **3856**

The Effect of a Direct Current Potential on the Initiation of a Radiofrequency Discharge.—F. Kirchner. (*Phys. Rev.*, 15th Aug. 1947, Vol. 72, No. 4, p. 348.) The effect discussed by Varela (2397 of August) was described by the author in 1925 (*Ann. Phys., Lpz.*, Vol. 77, p. 287) and a satisfactory explanation given.

537.531 : 535.341 **3857**

Contribution to the Study of the Measurement of the Absorption of X Rays by Matter.—J. Devaux. (*Ann. Radioélect.*, April 1947, Vol. 2, No. 8, pp. 109–132.) A complete account of the author's method (2069 of July) with practical apparatus details and applications to organic liquids, H, C, O, N and to the point-to-point study of the composition of a binary alloy.

537.56 : 535.61-31 **3858**

Ion-Content of Air irradiated by Ultraviolet Light.—G. R. Wait. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 158.) Summary of Amer. Phys. Soc. paper. The number and mobility of various types of ions were examined. The results suggest an explanation for the coincidence of radio fade-outs and solar flares.

537.583 : 621.385.1.032.216 **3859**

Variations in the Constants of Richardson's Equation as a Function of Life for the Case of Oxide Coated Cathodes on Nickel.—H. Jacobs & G. Hees. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 174.) Summary of Amer. Phys. Soc. paper.

538.11 **3860**

The Mechanism of Magnetic Attraction.—G.W.O.H. (*Wireless Engr*, Sept. 1947, Vol. 24, No. 288, pp. 253–254.) The observed effects are explained by considering the forces acting on orbital electrons in a non-uniform magnetic field.

538.221 **3861**

Ferromagnetic Resonance at Microwave Frequencies.—W. A. Yager & R. M. Bozorth. (*Phys. Rev.*, 1st July 1947, Vol. 72, No. 1, pp. 80–81.) 'Supermalloy' foils were used as the narrow walls of a resonant cavity formed from a section of rectangular guide. The cavity was connected through a standing wave detector to a 1.25-cm wavelength source; measurements were made of the apparent permeability as a function of the strength of a static magnetic field applied in the plane of the foils. From the characteristics of the sharp resonance phenomenon observed at $H = 4920$ oersteds, a value of 2.17 for the Landé splitting factor was derived. The experimental results were also consistent with a relaxation time of 1.2×10^{-9} sec, using a damping term of the form suggested by Frenkel. See also 747 of March (Griffiths).

538.3 **3862**

On the Electromagnetic Energy of an Isolated System.—L. Bloch. (*Rev. gén. Élect.*, June 1947, Vol. 56, No. 6, pp. 270–275.) Various classical expressions for electromagnetic energy are cited, including the case where the medium is the seat not only of charges and currents, but also of electric and magnetic moments. It is shown that the Maxwell-Lorentz theory includes a term of simple form for the interaction between the ether and matter. The possible use of a similar term is suggested when the electromagnetic field is replaced by a meson field and the electrons by neutrons. This would help in understanding the passage from electromagnetic physics to nuclear physics.

538.3 **3863**

Electromagnetic Field of Multipoles.—V. Berestetski. (*Zh. eksp. teor. Fiz.*, 1947, Vol. 17, No. 1, pp. 12–18. In Russian.)

538.56 **3864**

Electromagnetic Waves in a Vacuum: Relative Directions of the Electric and Magnetic Vectors.—G.W.O.H. (*Wireless Engr*, Sept. 1947, Vol. 24, No. 288, p. 277.) Comment on 3503 of November (Japolsky).

538.566 **3865**

Calculation of the Reflecting Power of an Arbitrarily Stratified System.—A. Herpin. (*C. R. Acad. Sci., Paris*, 21st July 1947, Vol. 225, No. 3, pp. 182–183.) A method using a matrix characteristic of each medium, such that the corresponding matrix for passage from the first to the last medium is simply the non-commutative product of the partial matrices. Reflection and transmission formulae are given. The method can be extended to isotropic layers for any incidence, double-refracting layers, etc.

538.569.4.029.64 **3866**

Paramagnetic Resonance Absorption at 9 000 Mc/s for Five Salts of the Iron Group.—R. L. Cummerow, D. Halliday & G. E. Moore. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 173.) Summary of Amer. Phys. Soc. paper.

538.569.4.029.64 **3867**

Stark and Zeeman Effects in Microwave Spectroscopy.—D. K. Coles & W. E. Good. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 157.) Summary of Amer. Phys. Soc. paper.

538.569.4.029.64 : 546.171.1 **3868**

Precision Frequency Measurements of Microwave Absorption Lines and Their Fine Structure.—W. E. Good & D. K. Coles. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 157.) Summary of Amer. Phys. Soc. paper. The absorption frequencies of ammonia and other gases have been measured with accuracy better than 1 in 10^6. Frequency markers 0.008 cm^{-1} apart are provided in the 1.25-cm region by harmonics from a 240-Mc/s crystal-controlled oscillator. When frequencies are plotted against rotational quantum numbers, the results show deviations from a smooth curve, which are interpreted as a K-type doubling for which only one component of the doublet exists. See also 3097 of October.

538.569.4.029.64 : 546.171.1 **3869**

Hyperfine Structure in the Microwave Spectrum of Ammonia.—R. J. Watts & D. Williams. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 157.) Summary of Amer. Phys. Soc. paper. Recent studies are discussed and the observed spacings and relative intensities of the satellite lines are compared with the theoretically predicted values.

538.569.4.029.64 : 546.171.1 **3870**

Collision Broadening of the Inversion Spectrum of Ammonia at Centimetre Wave-Lengths : Part 1 — Self-Broadening at High Pressure.—B. Bleaney & R. P. Penrose. (*Proc. phys. Soc.*, 1st May 1947, Vol. 59, No. 333, pp. 418–428.) Experiments on the absorption spectrum of ammonia between 0.6 and 0.9 cm^{-1} are described, and the absorptions at pressures of 10 and 60 cm Hg are compared with those computed from the measurements on individual lines at a pressure of 0.5 mm Hg (3507 of November) assuming that line widths are proportional to pressure. At 60 cm pressure the observed attenuation at the lower frequencies is greater than that computed ; reasons for this are discussed.

538.569.4.029.64 : 546.171.1 **3871**

[Suggested explanation of] **Anomalous Values of Certain of the Fine Structure Lines in the Ammonia Microwave Spectrum.**—H. H. Nielsen & D. M. Dennison. (*Phys. Rev.*, 1st July 1947, Vol. 72, No. 1, pp. 86–87.)

538.569.4.029.64 : 546.265.2 **3872**

The Microwave Absorption Spectrum of Carbonyl Sulfide.—R. E. Hillger, M. W. P. Strandberg, T. Wentink & R. L. Kyhl. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 157.) Summary of Amer. Phys. Soc. paper.

538.632 **3873**

On the Sign of the Hall Effect.—A. Carrelli. (*Nuovo Cim.*, 1st Feb. 1946, Vol. 3, No. 1, pp. 40–49. In Italian, with English summary.) A modern interpretation of the effect is considered and applied to Bi. Measurements of the Hall constants for Bi-Sb alloys are given and discussed.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.82 **3874**

The Radio Detection of Meteor Trails and Allied Phenomena.—E. V. Appleton & R. Naismith. (*Proc. phys. Soc.*, 1st May 1947, Vol. 59, No. 333, pp. 461–472. Discussion, pp. 472–473.) The results of observations of (*a*) transient bursts of atmospheric ionization and (*b*) abnormal or sporadic E-layer ionization, are described ; these effects are explained as due largely to sporadic meteors.

523.53 : 621.396.82 **3875**

Whistling Meteors.—D. W. Heightman : T. W. Bennington. (*Wireless World*, June 1947, Vol. 53, No. 6, p. 219.) Comment on 2407 of August (Garratt).

523.7 + 550.385]"1947.01/.03" **3876**

Solar and Magnetic Data, January to March, 1947, Mount Wilson Observatory.—S. B. Nicholson. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, p. 268.)

523.74 : 550.38 **3877**

A Slow Corpuscular Radiation from the Sun.—K. O. Kiepenheuer. (*Astrophys. J.*, May 1947, Vol. 105, No. 3, pp. 408–423.) Experimental data are presented showing that the solar filaments are sources of a slow corpuscular radiation having a mean speed of about 500 km/sec. Sunspots and coronal patches in the neighbourhood of the filaments destroy the correlation between the received corpuscular radiation and the filaments. The phenomena are also discussed from a theoretical standpoint ; the calculated corpuscular speed is in agreement with the observed value.

523.746 : 550.385 **3878**

Sunspots and Telegraphy.—C. H. Cramer. (*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 557–560.)

523.746"1947.01/.03" **3879**

Provisional Sunspot-Numbers for January to March, 1947.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, p. 174.)

523.75 : 550.385 **3880**

Magnetic Effects of Visible Solar Eruptions.—P. Bernard. (*C. R. Acad. Sci., Paris*, 30th June 1947, Vol. 224, No. 26, pp. 1811–1813.) Several instances are quoted where observed solar eruptions have been accompanied by sharp variations of one or more of the magnetic elements (H, V and D). A possible explanation is given of time discrepancies between eruptions and corresponding magnetic variations.

523.75 : 550.385 : 621.396.11 **3881**

Solar Limb Flare and Associated Radio Fade-Out, April 15, 1947.—E. T. Pierce. (*Nature, Lond.*, 12th July 1947, Vol. 160, No. 4054, p. 59.) Severe magnetic disturbances on April 17–18 and a major radio fade-out on April 15 are correlated with the appearance of a flare on the south-west edge of the sun's disk on April 15.

537.591 **3882**

Various Papers on Cosmic Rays.—(*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 171–173.) Summaries of the following papers at the Washington Meeting of the American Physical Society, May 1947 : The Latitude Effect of the Mesotron Component up to Elevations of 35 000 Feet, by M. Schein, P. S. Gill & V. Yngve. Discussion of a Possible Method for Measuring Masses of Cosmic-Ray Mesotrons, by W. H. Furry. Positive Excess of Slow Mesotrons at an Altitude of 11 500 Feet, by M. Correll. Theoretical Considerations on Large Air Showers, by H. A. Bethe. Interpretation of Cosmic-Ray Ionization Bursts in Cylindrical Chambers by Pulse Shapes, by H. Bridge. A Study of the Structure of Air Showers at 11 500 Feet, by R. W. Williams & B. Rossi. Cosmic-Ray Induced Nuclear Disintegrations at 11 500 Feet, by B. Rossi & R. W. Williams. High Energy Cosmic-Ray Air Showers, by P. J. Ovrebo & H. L. Kraybill. Atmospheric Showers of Cosmic Rays, by C. G. Montgomery & D. D. Montgomery. A V-2 Cosmic-Ray Experiment, by G. J. Perlow. Further Cosmic-Ray Experiments Above the Atmosphere, by E. H. Krause & S. E. Golian. Methods in Cosmic-Ray Measurement in Rockets by L. W. Fraser, R. P. Petersen, H. E. Tatel & J. A. Van Allen.

537.591 **3883**

On the Measurement of the Intensity of Cosmic Radiation by the Telescope Method.—S. A. Azimov, V. I. Veksler, N. A. Dobrotin, G. B. Zhdanov & A. L. Liubimov. (*Zh. eksp. teor. Fiz.*, 1947, Vol. 17, No. 1, pp. 79–86. In Russian.)

537.591 **3884**

Measurements of Cosmic Ray Intensity at 3 860 m and 5 000 m above Sea Level.—S. A. Azimov, V. I. Veksler, G. B. Zhdanov & A. L. Liubimov. (*Zh. eksp. teor. Fiz.*, 1947, Vol. 17, No. 1, pp. 87–91. In Russian.)

537.591 **3885**

On the Absorption and Disintegration of Mesons when Stopped.—M. Conversi, E. Pancini & O. Piccioni. (*Nuovo Cim.*, 1st Dec. 1946, Vol. 3, No. 6. pp. 372–390.)

537.591 **3886**

On the [cosmic ray] **Electron Component of the Lower Atmosphere.**—G. Bernardini, B. N. Cacciapuoti & B. Querzoli. (*Nuovo Cim.*, 1st Dec. 1946, Vol. 3, No. 6, pp. 349–371. In Italian, with English summary.)

537.591 **3887**

Measurement of the Slow Meson Intensity at Several Altitudes.—B. Rossi, M. Sands & R. F. Sard. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 120–125.)

537.591 : 5 **3888**

The Place of Cosmic Ray Research in the Physical Sciences.—P. M. S. Blackett. (*Sci. Culture*, May 1947, Vol. 12, No. 11, pp. 514–519.) The particles composing cosmic radiation are of fundamental importance because of their extremely high energy. Cosmic-ray research has also provided experimental confirmation of the existence of atomic particles predicted by nuclear theory, and has important connections with cosmology, geomagnetism and meteorology.

537.591.15 **3889**

Experimental and Theoretical Evaluation of the Density Spectra of Extensive Showers.—G. Cocconi, A. Loverdo & V. Tongiorgi. (*Nuovo Cim.*, 1st Feb. 1946, Vol. 3, No. 1, pp. 50–56. In Italian, with English summary.)

537.591.15 **3890**

The Transition Effect for Large Bursts of Cosmic-Ray Ionization : Part 2.—C. G. Montgomery & D. D. Montgomery. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 131–134.) For part 1 see *Phys. Rev.*, 1939, Vol. 56, p. 640.

538.12 : 521.15 **3891**

Magnetic Fields of Astronomical Bodies.—H. W. Babcock. (*Phys. Rev.*, 1st July 1947, Vol. 72, No. 1, p. 83.). " . . . within the uncertainties of the observations, the magnetic dipole moments of the earth, sun, and 78 Virginis . . . are proportional to their angular momenta. . ." On the assumption that this proportionality has universal application, numerical deductions are made concerning the magnetic moment of the Andromeda Nebula (M31). See also 3112 of October (Blackett) and 3892 below.

538.12 : 521.15 **3892**

On the Magnetism of Masses in Rotation.—A. Gião. (*C. R. Acad. Sci., Paris*, 30th June 1947, Vol. 224, No. 26, pp. 1813–1815.) It is shown that Blackett's formula for the magnetic moment of a quasi-spherical rotating mass (3112 of October) can be deduced very easily from the author's unitary theory of gravitation and electromagnetism (*Portugaliae Physica*, Vol. 2, 1, 1946, pp. 1–98 ; *Portugaliae Mathematica*, Vol. 5, 3, 1946, pp. 145–192). See also 3891 above.

550.372 **3893**

A New Method for the Determination of the Electric Constants of the Earth's Surface.—K. F. Niessen. (*Philips Res. Rep.*, Dec. 1946, Vol. 1, No. 6, pp. 465–475.) Two vertical transmitting dipoles are used, one situated immediately above the other, and the upper dipole is rotated slowly in a vertical plane. The phase difference is measured between the signals received from the two dipoles in a very distant high-flying aircraft moving towards the dipoles along a line in the plane of rotation of the upper dipole. From a knowledge of the two positions of the rotating dipole at which the phase difference is (*a*) zero, and (*b*) changes discontinuously by π, it is possible to calulate the dielectric constant and conductivity of the ground.

550.38"1945" **3894**

Mean Monthly Values of Magnetic Elements, Christchurch, New Zealand, All Days of 1945.—H. F. Baird. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, p. 188.)

550.38"1946.07/.12" **3895**

Five International Quiet and Disturbed Days for July to December 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, p. 265.)

550.384.4 : 551.594 **3896**

Electric Current as a Probable Cause of Daily Magnetic Variation.—K. Terada. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, pp. 189–200.) Translation of a Japanese paper read in 1941 at a meeting of the Physico-Mathematical Society of Japan.

Simple formulae are derived for estimating, from observed magnetic data, the height of the ionospheric current sheet which could cause the daily variations of the earth's magnetic field. It is concluded that the height is about 100 km, and that the implications of this result are in agreement with ionospheric radio-exploration data.

550.385"1931/1940" **3897**

Dual Laws of the Course of Magnetic Disturbances and the Nature of Mean Regular Variations.—A. P. Nikolsky. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, pp. 147–173.) An analysis of magnetic storm data obtained from high-latitude observatories of the U.S.S.R., particularly Tikhaya Bay, during 1931–1940.

550.385"1947.01/.03" **3898**

Principal Magnetic Storms [Jan.–March 1947].—(*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, pp. 270–288.)

551.51 : 525.624 **3899**

Atmospheric Oscillations.—(*Observatory*, Aug. 1947, Vol. 67, No. 839, pp. 128–131.) Report of Royal Astronomical Society discussion, January 1947.

551.510.5 : 525.624 : 550.384 **3900**

Terrestrial Influences in the Lunar and Solar Tidal Motions of the Air.—O. R. Wulf & S. B. Nicholson. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, pp. 175–182.)

551.510.53 **3901**

Exploration of the Upper Atmosphere by means of Rockets.—H. E. Newell, Jr. (*Sci. Mon., N.Y.*, June 1947, Vol. 64, No. 6, pp. 453–463.) Details of some of the special equipment used in V-2 rocket experiments at White Sands, New Mexico, including spectroscopy and cosmic-ray apparatus, telemetering, etc. A full account of the contribution of the Naval Research Laboratory is given in Upper Atmosphere Reports No. 1 & No. 2 (*Naval Research Laboratory Reports* R-2955 & R-3030, 1st Oct. & 30th Dec. 1946.)

551.510.535 **3902**

The True Height of an Ionospheric Layer.—J. A. Pierce. (*Phys. Rev.*, 15th May 1947, Vol. 71, No. 10, pp. 698–706.) A method is described "for the analysis of ionospheric sweep-frequency records in terms of the scale height and true height of maximum of the layer of Chapman form which most closely fits the observed data. It is shown that the height of maximum determined by the method of Appleton [395 of 1938], Booker, and Seaton [2145 of 1940] is the height of a parabolic layer which is not coincident with the parabola that most closely fits the Chapman distribution.

551.510.535 **3903**

On the Evaluation of the Parameter σ_0 in Chapman's Formula for determining the Ionic Density of the E Layer.—M. M. Sengupta & S. K. Dutt. (*Indian J. Phys.*, Feb. 1947, Vol. 21, No. 1, pp. 1–6.) σ_0 has a diurnal and seasonal variation between the limits 0.1 and 0.02 for latitudes 24° to 30° N or S.

551.593.9 + 551.594.5 **3904**

Emission Spectra of the Night Sky and Aurorae.—A. H. (*Observatory*, Aug. 1947, Vol. 67, No. 839, pp. 121–127.) Report of an international conference in London in July 1947.

551.594 **3905**

Currents of Atmospheric Electricity.—J. A. Chalmers & E. W. R. Little. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, pp. 239–260.) Description of recordings of the charge brought to an electrically isolated area by conduction and precipitation, and of the apparatus used. Point-discharge is also considered. Some special phenomena are analysed.

551.594 : 550.384.4 **3906**

Diurnal Variations of Computed Electric Currents in the High Atmosphere.—E. Sucksdorff. (*Terr. Magn. atmos. Elect.*, June 1947, Vol. 52, No. 2, pp. 201–215.)

551.594.21 **3907**

Some Aspects and Recent Results of Electromagnetic Effects of Thunderstorms.—H. A. Norinder. (*J. Franklin Inst.*, Aug. & Sept. 1947, Vol. 244, Nos. 2 & 3, pp. 109–129 & 167–207.) "A comprehensive article concerning the electromagnetic properties and effects of lightning discharges obtained at the Institute [of High Tension Research in the University of Uppsala, Sweden] mainly during the war time and up to date." See also 3804 of 1945 and 1784 of June.

551.594.21 **3908**

Atmospheric Electricity and Lightning.—J. Frenkel. (*J. Franklin Inst.*, April 1947, Vol. 243, No. 4, pp. 287–307.) Author's translation of a Russian paper. See also 2186 of 1946.

LOCATION AND AIDS TO NAVIGATION

534.88 : 534.417 **3909**

The German Use of Sonic Listening.—Holt. (*See* 3758.)

621.396.933 **3910**

Radio Technique in the Service of Long-Range Navigation [Loran].—E. Ya. Shchegolev. (*Nauka i Zhizn*, 1947, No. 2, pp. 2–7. In Russian.)

621.396.933 : 621.396.96 : 629.139.83 **3911**

Landing Aircraft with Ground Radar.—J. S. Engel. (*Elect. Commun.*, March 1947, Vol. 24, No. 1, pp. 72–81.) Description of a mobile equipment for assisting the landing of aircraft under conditions of poor visibility. A 10-cm search radar, replaced for the last 10 miles by a 3-cm precision radar, is operated from the airfield and corrects the course of the aircraft; appropriate instructions to the pilot are transmitted by R/T on a frequency in the band 100–150 Mc/s. The pilot is thus brought to a position 50 ft above the runway, after which landing is accomplished without further assistance from the ground.

621.396.933 : 629.13.052 **3912**

Radio Sounder for Measurement of Aircraft Height above Ground.—P. Giroud & L. Couillard. (*Ann. Radioélect.*, April 1947, Vol. 2, No. 8, pp. 150–172.) A f.m. transmitter on the aircraft radiates vertically downwards. The wave reflected from the ground is picked up on a separate receiving aerial and superimposed upon a fraction of the transmitted wave, giving a beat frequency which is directly proportional to the aircraft height. In the case of the 'Aviasol' apparatus, the beat frequency is read directly on a dial instrument with two ranges, 0–300 m and 0–1 500 m. Details are given, with photographs and circuit diagrams, of transmitter, receiver, dipole aerials and indicator.

621.396.96 **3913**

Basic Equations in Radiolocation.—S. I. Tetelbaum. (*Radiotekhnika, Moscow*, Feb. 1947, Vol. 2, No. 2, pp. 24–34. In Russian with English summary.) Relations are derived between the transmitted power, receiver sensitivity and the maximum range for non-radiating objects.

621.396.96 : 621.396.615.17 : 621.317.755 **3914**

Radial Time Bases.—Dummer & Franklin. (*See* 3829.)

621.396.96 : 621.396.67 **3915**

Radar Antennas.—Friis & Lewis. (*See* 3796.)

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **3916**

The Design of an Ionization Manometer Tube.—D. L. Hollway. (*Proc. Instn Radio Engrs, Aust.*, April & May 1947, Vol. 8, Nos. 4 & 5, pp. 14–19 & 4–10.) A recently developed ionization manometer tube is described having a high sensitivity substantially independent of electrode potential variations. Published measurements of ionization efficiency are compared and used to predict the sensitivity with different gases. Errors from various causes are considered. The curves used in the sensitivity calculation apply to any design.

533.5 : 621.3.032.53 **3917**

Metal-Ceramic Brazed Seals.—R. J. Bondley. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 97–99.) A new method involves applying titanium hydride to the ceramic, then brazing to metals or similarly prepared ceramics with silver or any other metal that melts at 1 000° C. The resulting seals are strong and ideal for microwave valves.

533.5 : 621.3.032.53 **3918**

Glass-to-Metal Seals.—N. S. Freedman. (*Metal Ind., Lond.*, 23rd May 1947, Vol. 70, No. 21, pp. 378–380.) A plating process for the electrodeposition of silver on steel to withstand the temperatures encountered in the manufacture of h.f. valves.

535.37 **3919**

The Short-Period Time Variation of the Luminescence of a Zinc Sulphide Phosphor under Ultra-Violet Excitation.—M. P. Lord, A. L. G. Rees & M. E. Wise. (*Proc. phys. Soc.*, 1st May 1947, Vol. 59, No. 333, pp. 473–502.) A photographic method is described which permits observations up to 400 ms from the end of irradiation. The results are interpreted in terms of a bimolecular law, assuming two types of activating centre.

535.37 : 621.385.832 **3920**

The Efficiency of Cathodoluminescence as a Function of Current Density.—S. Lasof. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 165.) Summary of Amer. Phys. Soc. paper.

535.37 : 621.385.832 **3921**

Performance Characteristics of Long-Persistence Screens, Their Measurement and Control.—R. E. Johnson & A. E. Hardy. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 165.) Summary of Amer. Phys. Soc. paper. The efficiency of the primary-layer (phosphorescent) phosphor bears no consistent relation to screen performance, unless a method of pulsed light excitation is used. Average curves are given which show the variation of performance with baking temperature and the construction of the phosphor.

535.37 : 621.397.5 : 621.385.832 **3922**

Application of the I.C.I. Color System to the Development of the All Sulfide Television White Screen.—A. E. Hardy. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 166.) Summary of Amer. Phys. Soc. paper.

538.213 **3923**

Complex Permeability of Permalloy.—M. H. Johnson, G. T. Rado & M. Maloof. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 173–174.) Summary of Amer. Phys. Soc. paper. The behaviour of 45-Permalloy and Mo-Permalloy is similar to that of magnetic iron. For method of measurement see 2852 of September and 3182 and 3183 of October.

546.41/.431].64 : 621.385.1.032.21 **3924**

The Methods of Manufacture of Carbonates for Valve Cathodes.—C. Biguenet & C. Mano. (*Le Vide, Paris*, July/Sept. 1946, Nos. 4/5, 6 pp. Reprint.) Methods for the carbonates of Ba, Sr and Ca. The crystalline structure depends on the method used and this may account for observed differences in the emissive properties.

548.0 : 537 : 546.331.2 **3925**

Elastic, Piezoelectric, and Dielectric Properties of Sodium Chlorate and Sodium Bromate.—W. P. Mason. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, pp. 391–392.) Summary of 752 of March.

549.514.51 **3926**

Variations in Crystal Quartz.—C. P. Glover & K. S. Van Dyke. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 175.) Summary of Amer. Phys. Soc. paper.

620.197 : 669.58 **3927**

Zinc Plating for Corrosion Resistance and Decorative Finishing.—W. F. Coxon. (*Metal Treatm.*, Spring 1947, Vol. 14, No. 49, pp. 38–40.)

620.197 : 679.5 **3928**

Stabilizing Electrical and Mechanical Characteristics of Circuits [by embedding them in a casting resin].—(*Electronics*, July 1947, Vol. 20, No. 7, pp. 136, 138.) A suitable resin, developed by the National Bureau of Standards, has the required h.f. characteristics, quick polymerization with small volume change at low temperature and atmospheric pressure, and low viscosity and surface tension, so that it penetrates into small openings.

Rubber jackets fitted round valves protect them from thermal and mechanical shock.

621.315.611.011.5 + 537.226.3 **3929**

The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Solid Dielectrics : Part 5.—M. Gevers. (*Philips Res. Rep.*, Dec. 1946, Vol. 1, No. 6, pp. 447–464.) Results are given of measurements of the power factor and of the temperature coefficient of the dielectric constant of a number of well-known materials as functions of temperature and frequency. Anomalous cases are discussed. It is shown that all the experimental results are in accordance with the theory advanced in part 4 (3572 of November).

621.315.612.4 : 546.431.823 : 538.662.13 **3930**

Curie Point of Barium Titanate.—M. G. Harwood, P. Popper & D. F. Rushman. (*Nature, Lond.*, 12th July 1947, Vol. 160, No. 4054, pp. 58–59.) A range of temperatures, 122°–129°C, is found in which the tetragonal and cubic forms of $BaTiO_3$ coexist, the cubic phase appearing at 122°C and the tetragonal disappearing at 129°C. A high permittivity maximum is observed at 125°C.

621.315.616 **3931**

Low-Loss Plastic Insulation Materials.—J. H. Parliman. (*Electronics, Buyers' Guide Issue*, June 1947, Vol. 20, No. 6B, pp. 116–121.) Electrical, mechanical and chemical properties of materials commercially available are tabulated and briefly discussed.

621.315.616 **3932**

The Current-Creep Problem with Artificial [insulating] **Materials.**—B. Frischmuth. (*Schweiz. Arch. angew. Wiss. Tech.*, May 1944, Vol. 10, No. 5, pp. 156–160.) Discusses the mechanism of current creep and tracking. The author considers an irregular distribution of surface conductivity necessary for the occurrence of current creep.

621.315.62 : 621.315.612.6 **3933**

Toughened Glass Insulators.—(*Elect. Rev., Lond.*, 26th Sept. 1947, Vol. 141, No. 3644, pp. 461–466.) Description of production processes for pin-type (6.6–33 kV) and disk-type insulators for power lines with mechanical strengths up to 60 000 lb. See also 875 of 1941 (Hogg : E.R.A.).

621.316.99 **3934**

Present-Day Technique of Earthing of Electrical Installations.—D. Petrocokino. (*Rev. gén. Élect.*, May 1947, Vol, 56, No. 5, pp. 193–217.) A comprehensive review, including discussion of methods for protection of apparatus and personnel and for lightning protection, earthing of neutral points of power systems, etc. Consideration of shock effects shows that many old types of earth connection are very inefficient. Earthing technique requires revision.

621.318.2 **3935**

Permanent Magnets.—J. L. Salpeter. (*Proc. Instn Radio Engrs, Aust.*, April–July 1947, Vol. 8, Nos. 4–7, pp. 8–14, 10–17, 4–8 & 4–17.) A comprehensive discussion of (*a*) the demagnetization curve and the figure of merit for a permanent magnet, (*b*) the nature of ferromagnetism and ferromagnetic alloys, and (*c*) magnetic anisotropy and magnetic hardness.

621.318.2 : 518.4 **3936**

Permanent Magnets.—"Cathode Ray". (*Wireless World*, Aug. 1947, Vol. 53, No. 8, pp. 300–306.) Methods for obtaining the data necessary for the design of a permanent magnet with given air-gap dimensions and flux density. General procedures, based on the relations between magnetic flux, reluctance and magnetomotive force, are deduced by analogy with Ohm's law. Approximate graphical methods are outlined, using data obtainable from the B-H curve, and are illustrated by practical examples.

621.318.22 **3937**

Modern Magnetic Materials.—H. E. Finke. (*Materials & Methods*, June 1947, Vol. 25, No. 6, pp. 72–76.) Comparison of the physical and mechanical properties of modern magnetic alloys including the alnicos, cunife, cunico, vectolite and silmanal.

621.318.323.2.042.15 **3938**

Permeability of Dust Cores.—P. R. Bardell. (*Wireless Engr*, Aug. 1947, Vol. 24, No. 287, p. 249.) Reply to 3163 of October (Friedlaender).

621.318.323.042.15 **3939**

Permeability of Dust Cores.—H. W. Lamson. (*Wireless Engr*, Sept. 1947, Vol. 24, No. 288, pp. 267–270.) Expressions are derived for the longitudinal and transverse permeabilities of dust cores in terms of the dimensions of the magnetic granules, and other parameters. The ratios of the longitudinal to the transverse permeabilities are functions of the elongation of the granules; measurements of these permeabilities, made on a molybdenum-permalloy dust core, confirm Bardell's hypothesis of granular elongation (1693 of June). See also 3555 of November and back references.

621.357.9 : 669.27-426 **3940**

An Electrolytic Method for pointing Tungsten Wires.—W. G. Pfann. (*Metals Technol.*, June 1947, Vol. 14, No. 4, TP2210, 4 pp.) For forming points on wires 0.002–0.01 inch in diameter such as are required in crystal rectifiers. An aqueous potassium hydroxide solution containing a certain amount of copper is used as the electrolyte. Summary in *Metal Ind., Lond.*, 8th Aug. 1947, Vol. 71, No. 6, pp. 110, 112.

621.775.7 : 016 **3941**

Powder Metallurgy: An Indexed Bibliography of the Literature: Part 1.—G. H. S. Price. (*Metal Treatm.*, Spring 1947, Vol. 14, No. 49, pp. 42–65.) Over 600 references are given.

621.775.7 : 669.337 **3942**

Electrolytic Copper Powder.—(*Metal Ind., Lond.*, 12th Sept. 1947, Vol. 71, No. 11, pp. 226–227.) Abstract of B.I.O.S. report on production methods in Germany.

621.791.353 : 669.018.21 **3943**

Metallic Joining of Light Alloys: Parts 5–7.—(*Light Metals*, May, June & July 1947, Vol. 10, Nos. 112, 113 & 114, pp. 214–223, 273–275 & 365–368.) Application of electrical fusion to the joining of Al wire and strip; survey of patent literature on typical apparatus; theory and techniques of flame welding of Al. For parts 1–4, see 2152 of July and 2467 of August. To be continued.

621.946.148.12 **3944**

New Diamond Die Drilling Method revolutionizes Industry.—(*J. Franklin Inst.*, May 1947, Vol. 243, No. 5, pp. 424–428.) A new method for small dies used in drawing and shaping extremely hard and fine wire has been developed at the National Bureau of Standards. The process is carried out in ten steps combining h.v. electrical, l.v. electrolytic, and mechanical drilling, requires no specially skilled operators, produces better dies and saves almost 100 man-hours compared with older processes. For a complete account see *Bur. Stand. J. Res.*, May 1947, Vol. 38, No. 5, pp. 449–464 (C. G. Peters et al.).

669.14 : 538.652 : 621.314.1/.2 **3945**

Magnetostriction of Transformer Steel subjected to Thermomagnetic Treatment.—Ya. S. Shur & A. S. Khokhlov. (*Zh. eksp. teor. Fiz.*, 1947, Vol. 17, No. 1, pp. 7–11. In Russian.)

669.152.5 **3946**

A New Magnetic Alloy.—(*Machinery, Lond.*, 8th May 1947, Vol. 70, No. 1802, p. 490.) 'Hiperco,' a new ductile alloy for motors and generators. For another account see 2820 of September.

678 : 016 **3947**

Advances in Rubber during 1946.—E. F. Riesing & J. O. Callouette. (*Mech. Engng, N.Y.*, May 1947, Vol. 69, No. 5, pp. 373–379.) A review of developments in synthetic and natural rubbers, vulcanization, etc., with a bibliography of 172 papers.

679.5 : 016 **3948**

Advances in Plastics during 1946.—H. M. Richardson. (*Mech. Engng. N.Y.*, May 1947, Vol. 69, No. 5, pp. 370–372, 382.) A short review of progress, with a bibliography of 118 papers.

679.5 **3949**

British Catalogue of Plastics. [Book Review]—E. Molloy (Ed.). National Trade Press, London, 704 pp., 50s. (*Elect. Rev., Lond.*, 6th June 1947, Vol. 140, No. 3628, p. 930.) " This guide to selection, processing and uses is encyclopaedic in character and dimensions. . . . Specialist articles by thirty-five contributors are followed by makers' recommendations on moulding, fabricating and finishing. . . . A too-brief reference to uses in the electrical industry is mainly illustrative, while nine pages are devoted to the radio industry."

MATHEMATICS

517.9 **3950**

Perturbations of Discontinuous Solutions of Non-Linear Systems of Differential Equations.—N. Levinson. (*Proc. nat. Acad. Sci., Wash.*, July 1947, Vol. 33, No. 7, pp. 214–218.)

517.93 : 621.392 **3951**

A Note on Van Der Pol's Equation.—de Bruijn. (*See* 3814.)

518.5 **3952**

Recent Developments in Calculating Machines.—D. R. Hartree. (*J. Sci. Instrum.*, July 1947, Vol. 24, No. 7, pp. 172–176.) Based on a lecture to the Manchester and District Branch of the Institute of Physics, similar to the account noted in 2480 of August. Photographs of parts of recent U.S. machines are here included.

518.5 **3953**

High-Speed Electronic Digital Computers.—(*J. Franklin Inst.*, April 1947, Vol. 243, No. 4, pp. 323–326.) A short account of developments contemplated in connection with the production by the National Bureau of Standards of two electronic computers for the Bureau of Census and the Office of Naval Research.

518.5 **3954**

An Electronic Computer for Crystal Structure Analyses.—R. Pepinsky. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 175.) Summary of Amer. Phys. Soc. paper. For computation of two-dimensional Fourier series connected with electron densities in a crystal unit cell. The method is based on that of Bragg for the summation of simulated interference fringes.

MEASUREMENTS AND TEST GEAR

529.7 **3955**

Modern Methods of Timekeeping.—(*Observatory*, Aug. 1947, Vol. 67, No. 839, pp. 132–136.) Report of Royal Astronomical Society discussion, March 1947, when the relative merits of various methods, including astronomical observation and pendulum and quartz clocks, were considered.

621.317.081.3 + 53.081.3 **3956**

The Impending Change in the Electrical Units.—F. B. Silsbee. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 159.) Summary of Amer. Phys. Soc. paper. See also 2833 and 2834 of September.

621.317.1.011.5 : 621.392 **3957**

Drude's Second Method applied to the Measurement of Dielectric Permeabilities and to the Determination of Dipole Moments on the $\lambda = 10$ cm Wave.—A. P. Kapustin. (*Zh. eksp. teor. Fiz.*, 1947, Vol. 17, No. 1, pp. 30–40. In Russian, with English summary.) A magnetron with a ribbon circuit was used to measure the dielectric permeabilities of various binary systems and the dipole moments of molecules.

621.317.3 : 621.392.029.64 **3958**

Definition and Measurement of the Coefficient of Reflection in Waveguides.—Ortusi. (*See* 3788.)

621.317.333 + 621.317.37] : 621.315.212.029.6 **3959**

The Voltage Characteristics of Polythene Cables.—R. Davis, A. E. W. Austen & W. Jackson. (*J. Instn elect. Engrs*, Part I, June 1947, Vol. 94, No. 78, pp. 283–284.) Summary of 3179 of October.

621.317.336 + 621.317.733 **3960**

H.F. Impedance Measurements. [Impedance] **Bridge for the Range 10 kc/s–6 Mc/s.**—L. Katchatouroff & R. Delavenne. (*Câbles & Transmission, Paris*, April 1947, Vol. 1, No. 1, pp. 61–76. With English summary.) A discussion of the principal features of various types of impedance bridges and a description of a new bridge with equal ratio arms. Special attention was paid to the elimination of parasitic impedances. Results are given of tests made by the Laboratoire National de Radioélectricité.

621.317.336 **3961**

Impedance Measurements at V.H.F.—E. G. Hills. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 124–128.) In the region from 44 to 216 Mc/s the slotted transmission line is a simple device for measuring impedances. When used with a variable-reactance line that balances out reactive impedances, accuracy of measurement is increased and the apparatus can be readily adapted to measurements of aerial phasing and directivity. The method is suitable for large and rapid changes of frequency.

621.317.34 **3962**

Highly-Selective Transmission-Measuring Equipment for Communication Circuits.—D. G. Tucker. (*J. Instn elect. Engrs*, Part I, June 1947, Vol. 94, No. 78, p. 282.) Summary of 3181 of October. The full paper is also published in *J. Instn elect. Engrs*, Part II, June 1947, Vol. 94, No. 39, pp. 247–252.)

621.317.374 **3963**

A New Alternating Current Bridge for Precision Measurements.—J. W. L. Köhler & C. G. Koops. (*Philips Res. Rep.*, Dec. 1946, Vol. 1, No. 6, pp. 419–446.) A detailed description of a bridge permitting the use of ratios of 1, 10, 100 and 1 000 : 1. With any of these ratios phase differences may be measured with errors not exceeding 10^{-6} radian at frequencies between 1 and 100 kc/s. Using a variable air capacitor of 50 to 15 000 pF as a secondary standard, the losses of any capacitor between 50 pF and 1 μF can be measured.

The construction allows the ratio to be changed quickly and conveniently. The final design consists of a fixed centre part having four points to which the four branch impedances are connected. An exhaustive analysis of the various factors affecting the performance of the bridge is given.

621.317.39 : 531.765 **3964**

A Millisecond Chronoscope.—R. S. J. Spilsbury & A. Felton. (*J. Instn elect. Engrs*, Part I, June 1947, Vol. 94, No. 78, p. 284.) Summary of Measurements Section paper. A portable instrument of simple design. The range is 2.0–1 000 ms and accuracy is of the order of 0.5 ms for short intervals and 0.5% for long intervals. Another summary noted in 1137 of April.

621.317.726 **3965**

A Pulse Peak Kilovoltmeter.—L. U. Hibbard. (*J. sci. Instrum.*, July 1947, Vol. 24, No. 7, pp. 181–186.) The instrument measures pulses of length greater than 0.25 μs, recurrence frequency not less tha 50 c/s, and maximum amplitude 30 kV, to an accuracy of 3%. The attenuator is of the capacitor type and incorporates guard rings, so that its characteristics can be calculated accurately. The effects of stray capacitance and of pulse characteristics on the accuracy are discussed.

621.317.738 : 621.385.1 **3966**

A Radio-Frequency Interelectrode-Capacitance Meter.—F. J. Lehany & W. S. McGuire. (*A.W.A. tech. Rev.*, April 1947, Vol. 7, No. 3, pp. 271–282.) The design and calibration of the instrument, which is direct reading in the range 0.000 1–2 pF. A system of interchangeable shielded panels enables it to be used for a wide variety of valves, with accuracy within 5%.

621.317.76 : 621.396.621.54 **3967**

Measurement of Superheterodyne Tracking Errors.—H. A. Ross & P. M. Miller. (*A.W.A. tech. Rev.*, April 1947, Vol. 7, No. 3, pp. 327–336.) The nominal i.f. of the receiver is heterodyned against a crystal oscillator adjusted to the exact value. The frequency of the resultant beat note is used as a measure of the tracking error over the tuning range.

621.317.79 : 621.315.212 **3968**

Theory and Design of the Reflectometer.—B. Parzen & A. Yalow. (*Elect. Commun.*, March 1947, Vol. 24, No. 1, pp. 94–100.) The 'reflectometer' has been designed for the measurement of standing wave ratios, reflection coefficient, and power transfer on coaxial lines operated at frequencies of 1 000 Mc/s and below.

621.317.79 : 621.396.615.12 **3969**

A Signal Generator for Frequency and Amplitude Modulation.—W. S. McGuire. (*A.W.A. tech. Rev.*, April 1947, Vol. 7, No. 3, pp. 283–293.) Output in the range 3–14 Mc/s is obtained by the beat-frequency method, using a variable-frequency oscillator tunable over the range 23–34 Mc/s and a constant-frequency 20-Mc/s oscillator, derived by multiplication from a 5-Mc/s oscillator to which f.m. is applied by a reactance valve, with a maximum deviation of ± 25 kc/s, giving a maximum deviation of ± 100 kc/s in the output. A 400-c/s modulation oscillator is included and provision made for a.m.

621.317.79 : 621.396.615.12 **3970**

The Standard Generator, 10 kc/s-55 Mc/s, of the Société Alsacienne de Constructions Mécaniques (S.A.C.M.).—G. Couanault & P. Herreng. (*Câbles & Transmissions, Paris*, July 1947, Vol. 1, No. 2, pp. 155–162. With English summary.) Full details of a generator for which amplitude modulation from 0 to 100% can be provided by a 400-c/s internal oscillator or by an external source of frequency (*a*) 30 c/s–15 kc/s, (*b*) 50 c/s–3 Mc/s, or by a telegraph relay.

3971

621.317.79 : 621.396.615.12] : 621.396.621.001.4

Central Signal Generator for [receiver] **Production Testing.**—F. Miller. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 100–105.) Modulated frequencies are supplied to 25 test stations. Coupling, impedance matching, attenuator design, radiation and leakage are discussed.

621.317.79.089.6 : 621.396.615.12/.14 **3972**

A Method of calibrating Standard-Signal Generators and Radio Frequency Attenuators.—G. F. Gainsborough. (*J. Instn elect. Engrs*, Part I, June 1947, Vol. 94, No. 78, pp. 280–281.) Summary of 3202 of October.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.7/.9].001.8 **3973**

Applications of Sonic and Ultrasonic Vibrations.—A. A. McKenzie & F. Rockett. (*Electronics, Buyers' Guide Issue*, June 1947, Vol. 20, No. 6B, pp. 140–141.) A list, arranged according to frequency, ranging from the killing of germ life in canned foods to submarine detection and the emulsification of immiscible liquids.

534.321.9.001.8 : 621.396.611.21 **3974**

Laboratory Supersonic Generators and Their Applications.—Tscherning. (*See* 3757.)

537.531 : 535.341 **3975**

Contribution to the Study of the Measurement of the Absorption of X Rays by Matter.—Devaux. (*See* 3857.)

537.533.8 **3976**

A Microwave Secondary Electron Multiplier.—M. H. Greenblatt & P. H. Miller, Jr. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 160.) Summary of Amer. Phys. Soc. paper. Electrons are accelerated between two flat plates by a 3 000-Mc/s field whose strength is such that the transit time is a half-period, and are finally drawn off, after secondary multiplication, by a positive collector.

539.16.08 **3977**

Portable Geiger-Müller Counters.—W. Hushley & K. Feldman. (*Canad. J. Res.*, May 1947, Vol. 25, Sec. F, No. 3, pp. 226–235.) A description of three types of portable G-M counter suitable for field use. The high voltage in each tube is supplied by means of a multivibrator circuit, and the pulse from the tube is fed to a trigger circuit which operates headphones. Details of circuit design and application are given.

539.16.08 **3978**

A General Method for determining Coincidence Corrections of Counting Instruments.—T. P. Kohman. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 181.) Summary of Amer. Phys. Soc. paper.

539.16.08 **3979**

Fluctuations for Proportional Counters.—H. S. Snyder. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 181.) Summary of Amer. Phys. Soc. paper.

539.16.08 **3980**

Properties of Ion Counters operating at Low Potentials.—J. A. Simpson, Jr. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 181.) Summary of Amer. Phys. Soc. paper.

539.16.08 **3981**

Low Voltage Self-Quenching Counters.—S. H. Liebson. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 181–182.) Summary of Amer. Phys. Soc. paper.

539.16.08 **3982**

The Discharge Mechanism of Self-Quenching G-M Counters.—S. H. Liebson. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 187.) Summary of Amer. Phys. Soc. paper.

539.16.08 : 537.525.3 : 621.316.722.078.3 **3983**

The Voltage Stabilization Properties of the Continuous Corona Discharge.—I. H. Blifford & H. Friedman. (*Phys. Rev.*, 15th July, 1947, Vol. 72, No. 2, p. 185.) Summary of Amer. Phys. Soc. paper. An electronic stabilizer using positive wire continuous corona discharge between coaxial cylinders provides regulation to 0.1% at 40 kV for loads up to 10 mA. See also 1596 of May.

551.508.1 **3984**

A Coding Radiosonde of Rational Design.—N. Gibbs, L. Gibbs & E. W. Pike. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 160.) Summary of Amer. Phys. Soc. paper. Meteorological data are converted into Morse letter groups, so that only a receiver is required on the ground. The sonde construction is simple and economical.

621.316.7 : 621.313.2/.3]-9 **3985**

Basic Procedures in Motor Control: Parts 2-4.—G. W. Heumann. (*Gen. elect. Rev.*, June–Aug. 1947, Vol. 50, Nos. 6–8, pp. 41–46, 41–48 & 40–51.) D.c. shunt and compound motors, amplidyne control circuits and a.c. induction motors. Part 1, 3212 of October.

621.316.726 : 621.313.333 **3986**

Adjustable Frequency Control of High-Speed Induction Motors.—G. W. Heumann. (*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 576–579.) Abridged version of A.I.E.E. paper. Details of amplidyne and thyratron control systems.

621.317.792 **3987**

A Lightning Warning Device.—B. F. J. Schonland & P. G. Gane. (*Trans. S. Afr. Inst. elect. Engrs*, April 1947, Vol. 38, Part 4, pp. 119–123. Discussion, pp. 123–125.) The device gives audible warning of the occurrence of flashes within about 7 or about 20 miles, according to the position of a switch. Corona current in the aerial is used to give warning of imminent nearby flashes to ground.

621.318.572 **3988**

Electronic Relays.—R. van Steenkiste. (*Bull. sci. Ass. Inst. Montefiore*, July 1947, Vol. 60, No. 7, pp. 193–199.) Describes the use of triodes, thyratrons, photoelectric cells and neon tubes as relays for d.c. or a.c. circuits.

621.318.572 **3989**

A Diode Coincidence Circuit.—J. D. Shipman, Jr., B. Howland & C. A. Schroeder. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 181.) Summary of Amer. Phys. Soc. paper.

621.318.572 : 531.76 **3990**

Interval Timer.—E. L. Deeter & W. K. Dau. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 86–87.) "Timing periods in 0.1-second increments for the range 0.1 to 100 seconds can be set up on direct reading dials. The period depends upon reduction of control-tube bias by discharge of an RC circuit."

621.38 : 621.791.7 **3991**

Electronic Welding Equipment.—M. Félix. (*Bull. sci. Ass. Inst. Montefiore*, June 1947, Vol. 60, No. 6, pp. 163–175.) A general description of methods and apparatus for spot and seam welding, and butt resistance welding, including the use of thyratrons and ignitrons.

621.38.001.8 **3992**

Industrial Applications of Electronic Techniques.—H. A. Thomas. (*J. Instn elect. Engrs*, Part I, July 1947, Vol. 94, No. 79, pp. 309–331. Discussion, pp. 331–338.) Full paper. Summary noted in 2523 of August. A bibliography of 81 papers is included.

621.38.001.8 **3993**

Electronics — A New Branch of Technics.—S. E. Teleshevski. (*Nauka i Zhizn*, 1947, No. 2, pp. 8–12. In Russian.) Short historical survey.

621.38.001.8 **3994**

Electronics in Measurement.—L. G. Gitzendanner. (*Gen. elect. Rev.*, Aug. 1947, Vol. 50, No. 8, pp. 24–29.) Descriptions of a photoelectric recorder, spectrophotometer, vibration-velocity meter and other devices.

621.383.001.8 : 535.247.4 **3995**

Sensitive Photoelectric Photometer.—F. T. Gucker, Jr. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 106–110.)

621.384 + 621.319.3 **3996**

The Palletron, a New Electron Resonator and Its Proposed Application to the Generation of Potentials in the Million-Volt Range.—A. M. Skellett. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 180.) Summary of Amer. Phys. Soc. paper. Design of a proposed megavolt voltage generator, with experimental results on a small model.

621.384 **3997**

The Electron Mechanics of Induction Acceleration.—J. A. Rajchman & W. H. Cherry. (*J. Franklin Inst.*, April & May 1947, Vol. 243, Nos. 4 & 5, pp. 261–285 & 345–364.) The equations of electron motion in the betatron are developed and, with the aid of a potential function, previously reported conditions of equilibrium, stability and oscillation damping are derived for the region of parabolic and of non-parabolic variation of the potential. The application of an auxiliary radial electric field is discussed in detail without materially complicating the analysis. Experimental work complementing the theory is described.

621.384 : 621.396.611.4 **3998**

Acceleration of Electrons by a Single Resonant Cavity.—F. L. Hereford, Jr. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 159–160.) Summary of Amer. Phys. Soc. paper. Energies of 0.75 MeV at 17 μA were obtained from a cavity resonant at λ 75 cm. using a pulse length of 4 μs and 60 pulses/sec. The energy spectrum is remarkably narrow, about 50 keV. See also 2997 of 1946 (Bowen, Pulley & Gooden).

621.384 : 621.396.611.4.029.62 **3999**

Cavity Accelerator for Electrons.—H. L. Schultz, R. Beringer, C. L. Clarke, J. A. Lockwood, R. L. McCarthy, C. G. Montgomery, P. J. Rice & W. W. Watson. (*Phys. Rev.*, 15th Aug. 1947, Vol. 72, No. 4, pp. 346–347.) A linear electron accelerator consisting of a series of cylindrical cavities, operating in the TM$_{010}$ mode, which are not mutually coupled. Frequency and phase coherence in the separate cavities are provided by a master oscillator driving separate power amplifiers for the excitation of the various cavities. The system is designed for pulse operation at 580 Mc/s.

621.384.6 **4000**

Note on the 2.8 MeV Betatron.—W. B. Lasich & L. Riddiford. (*J. sci. Instrum.*, July 1947, Vol. 24, No. 7, pp. 177–179.) The construction and operation of a small laboratory betatron having a total ionization intensity equivalent to 1 gm of radium.

621.385.1.001.8 : 531.768.087 **4001**

A Vacuum Tube for Acceleration Measurement.—W. Ramberg. (*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 555–556.) For another account see 2528 of August.

621.385.833 **4002**

Experimental Determination of Astigmatism and of the Focal Surfaces in Electron Optics.—A. Cazalas. (*C. R. Acad. Sci., Paris*, 21st July 1947, Vol. 225, No. 3, pp. 178–180.)

621.385.833 **4003**

Limit of Resolution of the Decentred Electrostatic Objective.—H. Bruck. (*C. R. Acad. Sci., Paris*, 30th June 1947, Vol. 224, No. 26, pp. 1818–1820.) A formula is derived by considering the objective as made up of three independent elementary lenses, the two outer ones weakly divergent and the central one strongly convergent.

621.398+621.314.12 **4004**

Electric Positioning Systems of High Accuracy for Industrial Use.—D. E. Garr. (*Gen. elect. Rev.*, July 1947, Vol. 50, No. 7, pp. 17–24.) Description of a system using selsyns, valves, an amplidyne and a d.c. motor.

PROPAGATION OF WAVES

538.566.2 **4005**

Refraction of Plane Non-Uniform Electromagnetic Waves between Absorbing Media.—L. Pincherle. (*Phys. Rev.*, 1st Aug. 1947, Vol. 72, No. 3, pp. 232–235.) It is shown that after refraction there are two possible positions for the propagation vector in the second medium. Energy flow considerations show that each solution holds within a certain range of values of the (complex) angle of incidence, the transition between the two solutions being discontinuous. Polarizations perpendicular and parallel to the plane of incidence are considered.

621.396.11 **4006**

Observations on the Propagation of Ultra-Short Waves.—G. Latmiral & G. Barzilai. (*Alta Frequenza*, June/Aug. 1947, Vol. 16, Nos. 3/4, pp. 147–173. In Italian, with English, French and German summaries.) A critical discussion. It is pointed out that the phase diagram of aerials above the earth must be considered, that the radiation diagram may not be independent of distance and that reflection must not be supposed to occur at a single point. The finite dimensions of the reflecting zone, when the earth's surface is uneven, can produce notable variations in the signal strength of the reflected ray. U.s.w. fading may be reduced by the use of aerials connected together without phase synchronism.

621.396.11 **4007**

Radio-Wave Propagation and Electromagnetic Surface Waves.—P. S. Epstein. (*Proc. nat. Acad. Sci., Wash.*, June 1947, Vol. 33, No. 6, pp. 195–199.) A short critical account of the development of Sommerfeld's classical theory. Another interpretation of Sommerfeld's equations, hitherto overlooked, shows that the surface-wave is not generated by the aerial and can have an independent existence.

621.396.11.029.58 : 551.510.535 **4008**

Doppler Effect in Propagation.—R. E. Burgess : F. S. Atiya : L. Essen : H. V. Griffiths. (*Wireless Engr*, Aug. & Sept. 1947, Vol. 24, Nos. 287 & 288, pp. 248–249 & 279–280.) Criticism and correction of a statement by Griffiths (3254 of October) which implied that absolute velocity could be measured, thereby flouting the principles of relativity.

621.396.812.029.64 **4009**

Further Observations of the Angle of Arrival of Microwaves.—A. B. Crawford & W. M. Sharpless. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 389.) Summary of 1183 of April.

RECEPTION

621.396.621 + 621.396.69 **4010**

Robot makes Radios.—R. W. Hallows. (*Radio Craft*, Sept. 1947, Vol. 18, No. 12, pp. 20–21, 81.) Another account of the E.C.M.E. (Electrical Circuit Making Equipment) described in 1913 of June (Sargrove).

621.396.621 **4011**

A New Approach to F.M./A.M. Receiver Design.—D.G.F. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 80–85.) Full description of a double superheterodyne receiver ; the second local oscillator is crystal-controlled and good selectivity, sensitivity and signal/noise ratio are obtained with a minimum number of components.

621.396.621 **4012**

Clipping and Clamping Circuits.—N. W. Mather. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 111–113.) Basic circuits for removing that portion of a signal which exceeds a predetermined level or for passing only signals exceeding the clip level, and for restoring or changing average values of signals having level portions.

621.396.621 : 621.396.619.13 **4013**

Designing an F.M. Receiver : Part 2.—T. Roddam. (*Wireless World*, June 1947, Vol. 53, No. 6, pp. 203–206.) Limiter and discriminator circuits are considered in detail. For part 1 see 2365 of August ; an omission from Fig. 3 of this article is corrected.

621.396.621.029.5 **4014**

Universal Receiver RU95.—G. de Champs. (*Ann. Radioélect.*, April 1947, Vol. 2, No. 8, pp. 137–149.) The frequency range is 50 kc/s to 30 Mc/s. The general electrical design is discussed, the various stages being considered separately, and practical constructional details are given. Examination of all the factors involved in the calculation of the signal/noise ratio shows that the sensitivity approximates to the theoretical maximum. The construction and operation of the crystal filter is described and typical performance results of the receiver are given.

621.396.621.029.62 **4015**

BC-624 on Two Meters.—L. W. May, Jr. (*Radio Craft*, Sept. 1947, Vol. 18, No. 12, pp. 24–35..63.) Details of the modifications necessary for 2-m reception.

621.396.621.029.62 **4016**

Designing a 2 Meter Communication Receiver.—R. B. Tomer. (*Radio News*, Sept. 1947, Vol. 38, No. 3, pp. 57–59..146.) Full constructional details of a 144–148-Mc/s superheterodyne, incorporating an S-meter and a noise limiter. Special features include the use of separate assemblies in the more critical sections such as the i.f. channel, local oscillator, mixer, and r.f. amplifier.

621.396.621.52 **4017**

The Application of Super-Regeneration in Frequency-Modulation Receiver Design.—C. E. Tapp. (*Proc. Instn Radio Engrs, Aust.*, April 1947, Vol. 8, No. 4, pp. 4–7.) The principles of f.m. and super-regeneration are outlined and their combination in f.m. receivers suggested. A relatively small number of valves and tuned circuits would be required.

621.396.622 : 537.312.62 **4018**

Radio Frequency Detection by Superconductivity.—Andrews & Clark. (*See* 3853.)

621.396.813.015.3 : 621.396.645 **4019**

Analysis of Nonlinear Distortions owing to Transients in High-Power Class B Amplifiers.—A. M. Pesarevsky. (*Radiotekhnika, Moscow*, Feb. 1947, Vol. 2, No. 2, pp. 35–50. In Russian with English summary.) A study of the distortion due to transients in the anode and grid circuits and of the effect on this distortion of the complex character of the amplifier load.

621.396.823 **4020**

Interference from Industrial R.F. Heating Equipment.—A. Turney. (*British Electrical & Allied Industries Research Association Technical Report M/T88.*) The investigation is confined to four sets of apparatus of powers ranging from 2.5 to 45 kW operating on frequencies from 600 kc/s to 20 Mc/s. Both frequency and amplitude modulations were observed. An unscreened 25-kW equipment operating at 15 Mc/s produced fields greater than 100 μV/m over an area of half a square mile. Enclosing the apparatus in simple perforated steel cabinets gives considerable reduction in interference. Summary in *Wireless World*, Sept. 1947, Vol. 53, No. 9, p. 326. See also *Electronic Engng*, Aug. 1947, Vol. 19, No. 234, pp. 251–255.

621.396.828.029.62 **4021**

Reflector Antenna solves "Skip" Problem.—W. L. Campbell. (*Elect. World, N.Y.*, 2nd Aug. 1947, Vol. 128, No. 5, pp. 88, 90.) Serious interference with reception in Portland, Oregon, from eastern f.m. stations was very much reduced by using a 3-element beam aerial for reception only. The aerial has two parasitic elements, one a reflector and the other a director, giving a front-to-back ratio of 30 db. Addition of further reflectors is proposed to eliminate the slight residual interference.

STATIONS AND COMMUNICATION SYSTEMS

621.391.63 : 621.397.5 **4022**

Photovision.—A.Z. (*Toute la Radio*, June 1947, Vol. 14, No. 116, p. 175.) A short account of the Allen B. Du Mont system and possible applications of such systems.

621.391.64 : 621.327.44 **4023**

Modulation of the Resonance Lines in a Cesium Arc.—J. M. Frank, W. S. Huxford & W. R. Wilson. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, pp. 156–157.) Summary of Amer. Phys. Soc. paper. The light from a Cs arc Type CL2 is modulated by applying an alternating potential across the electrodes. The radiation is received by a photocell and displayed on an oscillograph together with the arc current and potential. The ratio of light to current modulation is about 0.8 for modulating frequencies below 1 kc/s and varies inversely as the square root of the frequency between 1 kc/s and 1 Mc/s. See also 3241 of October.

621.394/.395]"1939/1945" **4024**

Progress in Telephony and Telegraphy.—(*Engineering, Lond.*, 16th & 23rd May 1947, Vol. 163, Nos. 4242 & 4243, pp. 402–403 & 441.) Summary of 1206 of April (Radley).

621.395.44 **4025**

The Basic Principles of Carrier-Current Telephony.—H. Jacot. (*Tech. Mitt. schweiz. Telegr.-Teleph-Verw.*, 1st April & 1st June 1947, Vol. 25, Nos. 2 & 3, pp. 47–58 & 97–105.) A general account, with discussion of modulation methods, filters, including bridge-type crystal filters, h.f. generators for carrier currents, and the principal features of the System-U, developed by Siemens in Germany before the war, and of the Bell Laboratories' System-K.

621.396.1 **4026**

Channels of Communication : Why and How they require Bands of Frequency.—"Cathode Ray". (*Wireless World*, June 1947, Vol. 53, No. 6, pp. 223–226.)

621.396.44 : 621.315.052.63 **4027**

A New Single-Side-Band Carrier System.—B. E. Lenehan. (*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 549–552.) Two-phase currents, of the signal and carrier frequencies, are produced by phase-splitting circuits, and the outputs are multiplied together by two copper-oxide ring modulators. The carrier frequency is suppressed by passing d.c. through the signal paths.

621.396.619 **4028**

Modulation Types and Characteristics.—Rockett. (*See* 4061.)

621.396.619 : 621.396.822 **4029**

Noise Reduction and Bandwidth in the Principal Modulation Systems.—W. Nowotny. (*Elektrotech. u. Maschinenb.*, July/Aug. 1947, Vol. 64, Nos. 7/8, pp. 116–125.) A comparison of characteristic signal/noise ratios, with particular reference to pulse modulation, including both pulse time and pulse phase modulation. The relative ratios are given in a table and a diagram.

621.396.619.11/.13 **4030**

Comparison of A.M. and F.M.—D. A. Bell. (*Wireless Engr*, Sept. 1947, Vol. 24, No. 288, p. 279.) Comments on Nicholson's paper (3660 of November) emphasizing the advantages of f.m. over a.m.

621.396.619.16 : 621.396.5 **4031**

Methods and Equipment used in Multiplex Pulse Transmission.—G. Potier. (*Onde élect.*, June & July 1947, Vol. 27, Nos. 243 & 244, pp. 215–230 &

284–291.) The general principles of pulse modulation are outlined and the various methods hitherto used for modulation of pulse amplitude, duration or position are described. Methods of selecting the pilot pulses in receiving equipment are discussed and also the selection and detection of the signal pulses. Illustrative examples are given.

621.396.65.029.62/.64 : 621.396.619.16 **4032**

A Multichannel Microwave Radio Relay System.—H. S. Black, J. W. Beyer, T. J. Grieser, & F. A. Polkinghorn. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, pp. 388–389.) Summary of 1219 of April.

621.396.712 **4033**

Continuity Working.—R. T. B. Wynn. (*B.B.C. Quart.*, Jan. 1947, Vol. 1, No. 4, pp. 184–193.) A new method of presenting broadcast programmes allowing complete co-operation between programme staff and engineers even during the broadcast. The programme is controlled by an announcer from the continuity studio, sound-insulated from but connected to the continuity room, where two operators are responsible for the technical presentation. The technical facilities are described and the duties of those responsible for both technical and artistic presentation are discussed.

621.396.712.3 **4034**

Planning a Studio Installation : Part 1.—J. D. Colvin. (*Audio Engng*, July 1947, Vol. 31, No. 6, pp. 7–9, 41.) Concerned only with the audio equipment, wiring, etc. Each step in the planning is treated separately, then the steps are combined and the whole scheme completed.

621.396.931 **4035**

Mobile Radio-Telephone Service links Nation.—F. E. Butler. (*Radio News*, May 1947, Vol. 37, No. 5, pp. 45–47..118.) Fixed and mobile stations operate in the bands 152–162 Mc/s and 30–44 Mc/s respectively. A selective signalling device provides 2 030 combinations. Crystal control and phase modulation are the main features in the 30-W transmitters.

621.396.931 **4036**

F.M. Communications at CP's [Canadian Pacific] **Toronto Yard.**—(*Telegr. Teleph. Age*, May 1947, Vol. 65, No. 5, p. 6.) Shunting engines have been fitted with two-way f.m. radio communication equipment. The system has a possible range of 15 miles.

621.396.931 : 621.396.81.029.62 **4037**

153-Mc/s F.M. for Forestry Service.—R. L. Atkinson. (*F.M. & Televis.*, July 1947, Vol. 7, No. 7, pp. 23–26, 61.) A survey of results in the State of Florida with 15-W and 30-W transmitters shows that 20-mile communication ranges were consistently obtained.

621.396.932 **4038**

Modern Marine Radio.—D. F. Bowers & E. F. Cranston. (*Wireless World*, June 1947, Vol. 53, No. 6, pp. 221–222.) Two alternative standardized installations made by the Marconi Company for merchant ships are described, one for medium frequencies and the other for medium and high frequencies. Each consists of a transmitter, communication receiver, automatic alarm device and d.f. receiver. The transmitter frequency can be changed rapidly to predetermined values, and the equipment may be removed and serviced with the power on.

SUBSIDIARY APPARATUS

621-526 **4039**

The Development of Servo Mechanisms.—(*Elect. Times*, 22nd May 1947, Vol. 111, No. 2898, pp. 579–584.) Summary of the following papers read at the recent I.E.E. Convention on Servomechanisms. Fundamental Principles of Automatic Regulators and Servo Mechanisms, by A. L. Whiteley. Elements of Position Control, by K. A. Hayes. The Use of Servos in the Army during the Past War, by E. J. Douch. The Nature of the Operator's Response in Manual Control and Its Implications in Controller Design, by A. Tustin. Some Servo Mechanisms used by the Royal Navy, by J. O. H. Gairdner. Some Naval Applications of Electrical Remote-Positional Controllers, by W. E. C. Lampert. The Use of Servo Mechanisms in Aircraft, by A. A. Hall. The Theoretical Foundations of Process Control, by G. H. Farrington. Automatic Voltage Control of Generators, by C. Stewart. Amplidyne Regulating Systems, by B. Adkins. Automatic Control in the Chemical Industry, by J. W. Broadhurst, F. C. Broderick, A. W. Foster & G. E. Wheeldon, with four appendices. Some Industrial Electronic Servo and Regulator Systems by E. W. Forster & L. C. Ludbrook. Electronic Servo Simulators, by F. C. Williams & F. J. V. Ritson.

621.318.5 : 621.398 : 621.396.621 **4040**

Receiver Remote Control.—J. F. O. Vaughan. (*Wireless World*, June 1947, Vol. 53, No. 6, pp. 212–214.) A system using isolating capacitors and two relays enables a receiver to be switched on and off from an extension speaker by a push button without using additional connecting wires.

621.319.3.027.89 **4041**

Aluminium and Magnesium in the Electrical Industries. [Electrostatic generators.]—B. J. Brajnikoff. (*Light Metals*, July 1947, Vol. 10, No. 114, pp. 325–332.) An account of the principles, and construction of h.v. electrostatic generators, giving voltages up to 25 MV. Al is used largely in the construction of these generators.

621.319.33 **4042**

New Electrostatic Influence Generator.—P. Jolivet. (*C. R. Acad. Sci., Paris*, 21st July 1947, Vol. 225, No. 3, pp. 177–178.) Similar in construction to that previously described (1934 Abstracts, p. 53) but with no moving connections. The combs are connected through resistors to the corresponding armatures.

621.319.33 **4043**

Electrostatic Influence Machines and the Modernizing of Their Technique.—P. Jolivet. (*Rev. gén. Élect.*, June 1947, Vol. 56, No. 6, pp. 243–255.) A short historical review is given, with a new classification of such machines. The operation of generators with a new method of inductor mounting is described and also research on generators operating in compressed air. Technical details are given of machines actually constructed for use in compressed gas, which enables much higher output voltages to be reached. The design of generators of this type for still higher voltages is discussed. An output of 15 mA at 150 kV appears practicable.

621.319.33 **4044**

Electrostatic Sources of Electric Power.—J. G. Trump. (*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 525–534.) A general article on their production and use. The Van de Graaff belt generator is described, with details of modern generators of this type. Modifications include the control of the electric field round the upper terminal by means of intermediate metallic equipotential shields, and confining the charge on each belt by spaced conducting rods connected to the column sections and mounted close and parallel to each side of the belt. The insulation for these generators is either compressed gas or high vacuum, and the properties of some typical gases are given. The proposed use of vacuum-insulated electrostatic machinery, an a.c. synchronous motor and a d.c. generator for operation in a high vacuum, and the direct use of atomic power by means of a vacuum-insulated motor of the type described, are also discussed.

621.396.682 : 621.316.722.076.7 **4045**

Stabilizing Direct-Voltage Supplies.—J. W. Hughes. (*Wireless Engr*, Aug. 1947, Vol. 24, No. 287, pp. 224–230.) "A graphical method of assessing the performance of the gas-discharge tube stabilizer circuit is described, and a means of ensuring that the tube 'strikes' with low supply voltages is indicated."

621.396.682 : 621.316.722.1 **4046**

Voltage-Regulated Power Supplies.—P. Koontz & E. Dilatush. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 119–123.) A simplified design theory. Actual values of circuit elements necessary to build a power pack and electronic regulator are calculated. Practical suggestions are given for physical layout and elimination of ripple.

621.396.682 : 621.397.62 **4047**

Television E.H.T. [extra-high voltage] **Supply.**—W. T. Cocking. (*Wireless World*, June 1947, Vol. 53, No. 6, pp. 207–211.) The design of rectifier systems for supplying high voltage for television receiver c.r. tubes using the voltage developed across the line amplifier output transformer at flyback. Equations and experimental data are given showing the effect of stray capacitance across the transformer primary and the use of a tapped primary to step up the flyback voltage. A voltage-doubling rectifier system using components rated at half the output voltage is described.

TELEVISION AND PHOTOTELEGRAPHY

621.397.335 **4048**

Television Synchronization.—A. W. Keen. (*Wireless World*, June 1947, Vol. 53, No. 6, p. 220.) Comment on 2261 of July (Cocking).

621.397.335 **4049**

Investigation of the Range of Stable Synchronization of a Synchronizing Generator.—V. N. Gorshunov. (*Radiotekhnika, Moscow*, Jan. 1947, Vol. 2, No. 1, pp. 62–72. In Russian with English summary.) The results obtained are shown graphically and a stability criterion is derived.

621.397.5 **4050**

Television.—V. K. Zworykin. (*J. Franklin Inst.*, Aug. 1947, Vol. 244, No. 2, pp. 131–145.) A general description of modern television apparatus including the R.C.A. simultaneous colour system.

621.397.5 : 535.37 : 621.385.832 **4051**

Application of the I.C.I. Color System to the Development of the All Sulfide Television White Screen.—A. E. Hardy. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 166.) Summary of Amer. Phys. Soc. paper.

621.397.5 : 535.88 **4052**

Projection Television.—(*Wireless World*, June 1947, Vol. 53, No. 6, pp. 227–228.) With plastic lenses, non-spherical surfaces can be produced cheaply, so that large-aperture systems combining high optical efficiency with freedom from spherical aberration become possible.

621.397.5 : 535.88 **4053**

The Projection of Images on a Screen.—R. Aschen. (*Télévis. franç.*, Aug. 1947, No. 28, pp. 11–12, 34.) Describes various types of optical systems and discusses briefly the production of moulded correction lenses of plexiglass.

621.397.5 : 535.88 **4054**

Reflective Optical System for Projection Television.—V. K. Zworykin. (*Radio News*, Sept. 1947, Vol. 38, No. 3, pp. 54–56 . . 155.) A description of the R.C.A. system using a high-current sharp-focus kinescope operated at 27 kV, a spherical mirror and a moulded plastic correction lens to give a 20-inch × 15-inch picture.

621.397.5(73) **4055**

Progress in Television.—G. R. Town. (*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 580–590.) A general discussion on the latest position in the U.S.A., dealing with the immediate future and its commercial problems. Monochrome television will not be ousted rapidly by colour television, as the F.C.C. have stopped the commercialization of colour television until it has reached a satisfactory state of development.

621.397.62 **4056**

Television Receiver Construction : Parts 6 & 7.—(*Wireless World*, Aug. & Sept. 1947, Vol. 53, Nos. 8 & 9, pp. 278–281 & 330–334.) Part 6 : Discussion of c.r. tube mounting. Part 7 : Description of the complete receiver unit, with list of components. For previous parts see 3687 of November and back references.

621.397.62 **4057**

Learn as You Build — Television.—A. Liebscher. (*Radio News*, Sept. 1947, Vol. 38, No. 3, pp. 39–42 . . 141.) Complete construction details for a television receiver using a 3-inch tube.

621.397.62 **4058**

Study of the Detection and Video-Frequency Amplification Stages for 455-Line Television Receivers.—J. Barthon. (*Télévis. franç.*, Aug. 1947, No. 28, pp. 18–21.) An explanation of the particular features of these stages and the functions of the various circuits and components, to enable service men, etc., to understand the operation of the apparatus they have to handle.

621.397.62 : 621.396.682 **4059**

Television E.H.T. [extra-high voltage] **Supply.**—Cocking. (*See* 4047.)

TRANSMISSION

621.396.61.029.62 : 621.396.712 **4060**

Frequency-Modulated Broadcast Transmitters for 88–108 Megacycles.—L. Everett. (*Elect. Commun.* March 1947, Vol. 24, No. 1, pp. 82–93.) A detailed description of a series of transmitters having r.f. outputs of 1, 3, 10, 20 and 50 kW respectively. The transmitters are crystal controlled and the radiated centre frequency is maintained to within ±1 kc/s. A 75-μs pre-emphasis circuit is provided at the a.f. input.

621.396.619 **4061**

Modulation Types and Characteristics.—F. Rockett. (*Electronics, Buyers' Guide Issue,* June 1947, Vol. 20, No. 6B, pp. 124–125.)

621.396.619.16 **4062**

Spectrum Analysis of Pulse Modulated Waves.—J. C. Lozier. (*Bell. Syst. tech. J.*, April 1947, Vol. 26, No. 2, pp. 360–387.) The elementary theory of spectrum analysis is reviewed and discussed. A complex pulse is resolved into a series of rectangular pulses, the spectra of which are known and can be combined vectorially. The spectra of pulse-position and pulse-width modulation are thus determined ; as the pulse repetition rate is increased pulse position modulation approximates to a form of phase modulation, while pulse-width modulation approximates to amplitude modulation of the pulse repetition frequency and of its harmonics present in the unmodulated pulse.

621.396.645 : 621.396.822 : 621.396.97 **4063**

Preamplifier Noise in F.M. Broadcasting.—A. E. Richmond. (*Audio Engng,* July 1947, Vol. 31, No. 6, pp. 15–16, 45.) Methods of testing and improving the signal/noise ratio are discussed.

VALVES AND THERMIONICS

621.383.4 + 546.28 **4064**

A New Bridge Photo-Cell employing a Photo-Conductive Effect in Silicon. Some Properties of High Purity Silicon.—G. K. Teal, J. R. Fisher & A. W. Treptow. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, pp. 392–393.) Summary of 1961 of June.

621.385.029.63/.64 **4065**

The Travelling-Wave Tube.—R. Kompfner. (*Wireless Engr,* Sept. 1947, Vol. 24, No. 288, pp. 255–266.) Expressions are derived for the amplification and noise factor of the travelling-wave valve. The modulation of the beam by the wave is first considered neglecting any reaction of such modulation on the wave ; similarly the wave produced by a modulated beam is investigated neglecting the effect of the wave on the modulation. The reaction of the modulated beam on the modulating wave is then determined and by repeating this process for an infinite number of actions and reactions, the complete interaction is calculated.

A coaxial line with a helical inner conductor is suitable for providing a wave having a velocity to which electrons can be accelerated easily. The development of such valves up to 1944 is described. See also 2286 of July.

621.385.029.63/.64 **4066**

Tentative Theory of the Travelling-Wave Valve.—J. Bernier. (*Onde élect.*, June 1947, Vol. 27, No. 243, pp. 231–243.) Reprint of 2974 of September, with correction of a slight error in that paper.

621.385.029.63/.64 **4067**

Tentative Theory of the Travelling-Wave Valve.—J. Bernier. (*Ann. Radioélect.*, April 1947, Vol. 2, No. 8, p. 195.) Correction to 2974 of September.

621.385.1 + 621.396.694 **4068**

New Receiving Valves.—(*Wireless World,* June 1947, Vol. 53, No. 6, pp. 228–229.) Details of British valves with B8A base. See also 3717 of November.

621.385.1 + 621.396.694 **4069**

Contemporary Receiving Tubes.—J. D. Askew. (*Electronics, Buyers' Guide Issue,* June 1947, Vol. 20, No. 6B, pp. 126–129.) Valves classified according to their functions for comparison with other types. See also 2976 of September.

621.385.1 : 621.317.738 **4070**

A Radio-Frequency Interelectrode-Capacitance Meter.—Lehany & McGuire. (*See* 3966.)

621.385.1.032.21 : 537.291 **4071**

Cathode-Design Procedure for Electron-Beam Tubes.—R. Helm, K. Spangenberg & L. M. Field. (*Elect. Commun.*, March 1947, Vol. 24, No. 1, pp. 101–107.) Based on a book entitled "The Production and Control of Electron Beams," published as secret material during the war and now out of print. The design procedure is an extension of the work of J. R. Pierce (4275 of 1940). Charts are given from which a cathode structure can readily be determined for any current and voltage and at any angle of beam convergence, over a wide range of these variables.

621.385.1.032.21 : 546.41/.431].64 **4072**

The Methods of Manufacture of Carbonates for Valve Cathodes.—Biguenet & Mano. (*See* 3924.)

621.385.1.032.216 : 537.583 **4073**

Variations in the Constants of Richardson's Equation as a Function of Life for the Case of Oxide Coated Cathodes on Nickel.—H. Jacobs & G. Hees. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 174.) Summary of Amer. Phys. Soc. paper.

621.385.2 **4074**

The High Frequency Response of Thermionic Diodes.—E. H. Gamble. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 160.) Summary of Amer. Phys. Soc. paper. The temperature-limited and space-charge-limited operations of planar and cylindrical diodes are analysed. The transient build-up of current in a planar diode on the sudden application of an external voltage is determined.

621.385.3/.5 **4075**

Study of Grid Current.—U. Zelbstein. (*Toute la Radio,* June 1947, Vol. 14, No. 116, pp. 168–172.) Discussion of : (*a*) the complex nature and the consequences of grid current, (*b*) the possibilities of using modern valves with the minimum of grid current, and (*c*) the photoelectric effect in electrometer tubes.

621.385.83.032.29 **4076**

High Current Electron Guns.—L. M. Field. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 390.) Summary of 1967 of June.

621.385.832 **4077**

A Cathode-Ray Tube for viewing Continuous Patterns.—J. B. Johnson. (*Bell Syst. tech. J.*, April 1947, Vol. 26, No. 2, p. 390.) Summary of 1640 of May.

621.385.832 : 535.37 **4078**

Performance Characteristics of Long-Persistence Screens, Their Measurement and Control.—Johnson & Hardy. (*See* 3921.)

621.385.832 : 535.37 **4079**

The Efficiency of Cathodoluminescence as a Function of Current Density.—S. Lasof. (*Phys. Rev.*, 15th July 1947, Vol. 72, No. 2, p. 165.) Summary of Amer. Phys. Soc. paper.

621.396.615.14 **4080**

Possibility of Oscillation at Ultra-High Frequency of Conventional Valves.—F. Cappuccini. (*Alta Frequenza*, June/Aug. 1947, Vol. 16, Nos. 3/4, pp. 196–200. In Italian, with English, French and German summaries.)

621.396.615.142.2 **4081**

On the Theory of the Klystron.—Ya Z. Tsipkin. (*Radiotekhnika, Moscow*, Jan. 1947, Vol. 2, No. 1, pp. 49–61. In Russian with English summary.) From the author's criterion for the stability of systems with retarded feedback the self-excitation conditions of transit and reflection klystrons are determined. From these conditions the relation between self-excitation regions and parameters determining the klystron operation is deduced simply.

621.396.615.142.2 **4082**

External Cavity Klystron.—P. G. Bohlke & F. G. Breeden. (*Electronics*, July 1947, Vol. 20, No. 7, pp. 114–118.) Development and characteristics of a 10-cm klystron with an external cavity. Output is about 100 mW. With a coaxial cavity the klystron covers the wavelength range 7–14 cm in single-mode operation; with a radial cavity the range is 6.5–8.1 cm.

621.396.615.142.2 **4083**

A Relatively High Power Klystron Oscillator using a Circuit resembling the Hartley.—Yu. A. Katsman. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 1, pp. 87–92. In Russian.) A modification of Lüdi's klystron (57 of 1942) is discussed (Fig. 1), in which a resonant coaxial line is used, whose ends are loaded with different capacitances. By suitably choosing these capacitances the required ratio of the standing wave voltages at the ends of the line can be obtained. One of these voltages can be used as the buncher voltage; the other will then represent the output voltage of the klystron. The system is thus divided into two parts and is similar to the well known Hartley circuit.

The operation of the system is discussed and the necessary conditions are established for the balancing of the phases and amplitudes.

621.396.615.17 **4084**

The Application of the Radiotron Type 807 Valve as a Frequency Doubler.—G. L. Edgecombe & J. G. Downes. (*A.W.A. tech. Rev.*, April 1947, Vol. 7, No. 3, pp. 251–269.) It is shown that 26 W output with an anode efficiency of 50% is both theoretically and practically realizable.

621.396.622.6 : 546.28 **4085**

Development of Silicon Crystal Rectifiers for Microwave Radar Receivers.—J. H. Scaff & R. S. Ohl. (*Bell Syst. tech. J.*, Jan. 1947, Vol. 26, No. 1, pp. 1–30.) Characteristic curves of early types are given. The need for a stable, easily replaceable type brought about the ceramic cartridge rectifier and later the shielded rectifier, the construction of which is discussed in some detail. The applications and performance of various types are given and improved modern production methods are indicated. See also 771 of 1946 (Cornelius).

621.396.622.63 : [546.28 + 546.289 **4086**

Silicon and Germanium Rectifiers.—(*See* 3831.)

621.396.822 **4087**

A Theory of Flicker Noise in Valves and Impurity Semi-Conductors.—G. G. Macfarlane. (*Proc. phys. Soc.*, 1st May 1947, Vol. 59, No. 333, pp. 366–375. Discussion, pp. 403–408.) A theory of contact noise at low frequencies assuming diffusion of mobile impurity centres on to the contact surface. A formula is derived for the flicker noise which is applicable to emission from oxide-coated filaments and to contacts in photo-conductive cells and rectifiers. "The spectral power density of the noise is found to depend on current j and frequency f as j^{x+1}/f^x where $1<x<2$."

621.396.822 **4088**

Spontaneous Fluctuations of Electricity in Thermionic Valves under Retarding Field Conditions.—D. K. C. MacDonald & R. Fürth. (*Proc. phys. Soc.*, 1st May 1947, Vol. 59, No. 333, pp. 375–388. Discussion, pp. 403–408.) The measured fluctuations are compared with those generated by a diode operating under saturation conditions. Under certain conditions of current and differential resistance of the valve, the classical Schottky formula is obeyed. The necessary limiting current can be calculated. Measurements of this type can be used for determining cathode temperatures in diodes.

621.396.822 : 519.24 **4089**

Statistical Analysis of Spontaneous Electrical Fluctuations.—R. Fürth & D. K. C. MacDonald. (*Proc. phys. Soc.*, 1st May 1947, Vol. 59, No. 333, pp. 388–403. Discussion, pp. 403–408.) Fluctuations were produced in a receiver of high natural frequency (0.1–1.0 Mc/s) and narrow bandwidth (1–6 kc/s) and recorded by means of a single-stroke c.r.o. The fluctuations were thus displayed as rapid oscillations, with the natural frequency of the receiver, whose amplitude R varied slowly and irregularly in time. The distribution function of R within a statistically stationary series of observations and the correlation between values of R separated by a finite time interval were found to be in good agreement with statistical theory.

MISCELLANEOUS

371.3 : 621.396 **4090**

Technical Educational Requirements of the Modern Radio Industry.—P. L. Gerhart. (*RCA Rev.*, March 1947, Vol. 8, No. 1, pp. 186–191.)

5+6] : 05(43) : 778.1 **4091**

Photostat Copies of German Scientific and Technical Papers.—(*Nature, Lond.*, 27th Sept. 1947, Vol. 160, No. 4065, p. 427.) A photostat service to provide workers in Great Britain with the full text of papers appearing in current German scientific journals, of which a very full list is sent regularly to the Bureau of Abstracts, 9-10 Savile Row, London, W.1. Any scientist requiring the full text of a German article referred to in a British Abstract publication should write direct to Research Branch E.C.O.S.C. (Photostat Service) 77 H.Q. C.C.G. (B.E.) A.V.A.-Göttingen, B.A.O.R. Payment is made in sterling to the Director of Accounts, Photostat Service, Foreign Office (German Section), Norfolk House, St. James' Square, London, S.W.1, at the rate of one guinea for the first 10 pages and 2s. 6d. for each additional page.

621.3.016.25 **4092**

The Sign of Reactive Power.—(*Elect. Engng, N.Y.*, June 1947, Vol. 66, No. 6, pp. 627–628.) Further comment on 971 of March ; see also 2642 of August and back references.

621.38/.39](083.72) **4093**

Wartime Words and Their Meanings.—C. DeVore. (*Electronics, Buyers' Guide Issue*, June 1947, Vol. 20, No. 6B, pp. 108–113.) Concise definitions of nearly 600 code names, abbreviations, slang and technical terms added to the language of electronics during the war years.

621.39"1939/1945" **4094**

Telecommunications in War.—A. S. Angwin. (*Engineering, Lond.*, 2nd May 1947, Vol. 163, No. 4240, pp. 367–368.) Summary of I.E.E. Radiocommunication Convention speech. See also 2644 of August.

621.395 : 061.24 C.C.I.F. **4095**

Short Account of the Work of the 14th Plenary Assembly of the C.C.I.F. [Comité Consultatif International Téléphonique] **at Montreux.**—R. Sueur. (*Câbles & Transmission, Paris*, July 1947, Vol. 1, No. 2, pp. 115–119. With English summary.) The principal recommendations are given and briefly analysed. See also 3373 of October (Schiess).

621.396 **4096**

Future Trends in Radio Communication.—C. C. Paterson. (*Engineering, Lond.*, 9th May 1947, Vol. 163, No. 4241, p. 379.) Summary of I.E.E. Radiocommunication Convention speech. See also 2649 of August.

621.396/.397 : 06.064 Paris **4097**

Radio and Television at the Paris Fair, 1947.—G. Giniaux. (*T.S.F. pour Tous*, June 1947, Vol. 23, No. 224, pp. 123–126.)

621.396(494) **4098**

The 25th Anniversary of Radio-Suisse.—A. Ch. (*Tech. Mitt. schweiz. Telegr.-Teleph Verw.*, 1st Aug. 1947, Vol. 25, No. 4, pp. 154–158. In French.) A review of the development of the society and of present radio communication facilities.

621.396 Marconi Company **4099**

Marconi Company's Jubilee.—(*Engineer, Lond.*, 2nd May 1947, Vol. 183, No. 4762, pp. 386–387.) Marked by an exhibition, showing the development of Marconi's invention from the first crude apparatus with a range of a few miles, to the most modern apparatus in world-wide use to-day.

621.396.67 **4100**

Who Invented the Aerial — Marconi or Popov ?—(*Wireless World*, Sept. 1947, Vol. 53, No. 9, p. 338.) Translation of some passages of an article by Marquis Luigi Solari on the April/May number of the Italian paper *L'Antenna*, confirming that Marconi was the inventor.

621.396.69 **4101**

[1947] **Chicago** [radio] **Parts Show.**—(*Radio Craft*, May 1947, Vol. 18, No. 8, pp. 41–46.) List of exhibitors, with brief descriptions of a few of the exhibits.

015(73) **4102**

United States Government Publications. [Book Notice]—United States Government Printing Office, Washington. A monthly catalogue, price $2.25 per annum ($2.85 abroad), issued by the Superintendent of Documents and including titles of a large number of papers issued by the Scientific Research and Development Office.

43-3=2 **4103**

German-English Dictionary for Electronics Engineers and Physicists. [Book Review]—B. R. Regen & R. R. Regen. J. W. Edwards, Ann Arbor, Mich., 1946, 358 pp., $6.00. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 260, 262.) Nearly 21 000 German technical terms in the fields of electronics and physics are listed alphabetically with English equivalents. Brief explanatory definitions are sometimes added.

621.3 **4104**

Principles of Electrical Engineering. [Book Review]—T. F. Wall. George Newnes Ltd., London, 40s. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, p. 269.) Unusual emphasis is given to fundamental aspects common to heavy and light current engineering. The mathematical treatment is always elegant and within the capacity of the undergraduate, who " will do well to build upon Dr. Wall's book as a foundation ".

ABSTRACTS AND REFERENCES INDEX

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, price 2s. 8d. (including postage). As supplies are limited our Publishers ask us to stress the need for early application for copies.

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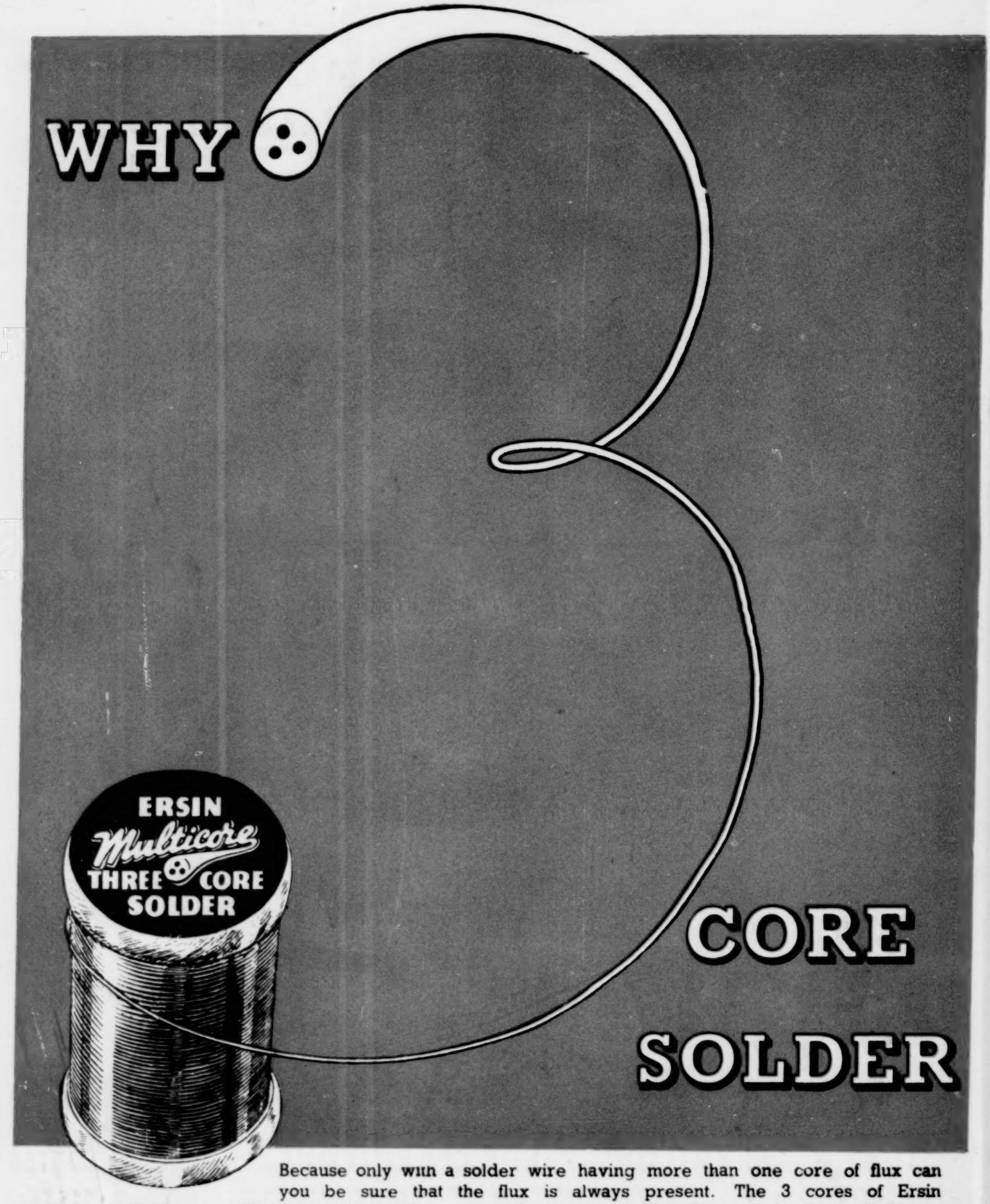

Because only with a solder wire having more than one core of flux can you be sure that the flux is always present. The 3 cores of Ersin Multicore Solder are filled with Ersin—the extra active non-corrosive flux. Only Ersin Multicore Solder can guarantee you freedom from dry joints, elimination of waste, rapid melting and speedy soldering. Write for technical information and free samples to Multicore Solders Ltd., Mellier House, Albemarle Street, London, W.1 or phone REGent 1411.

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